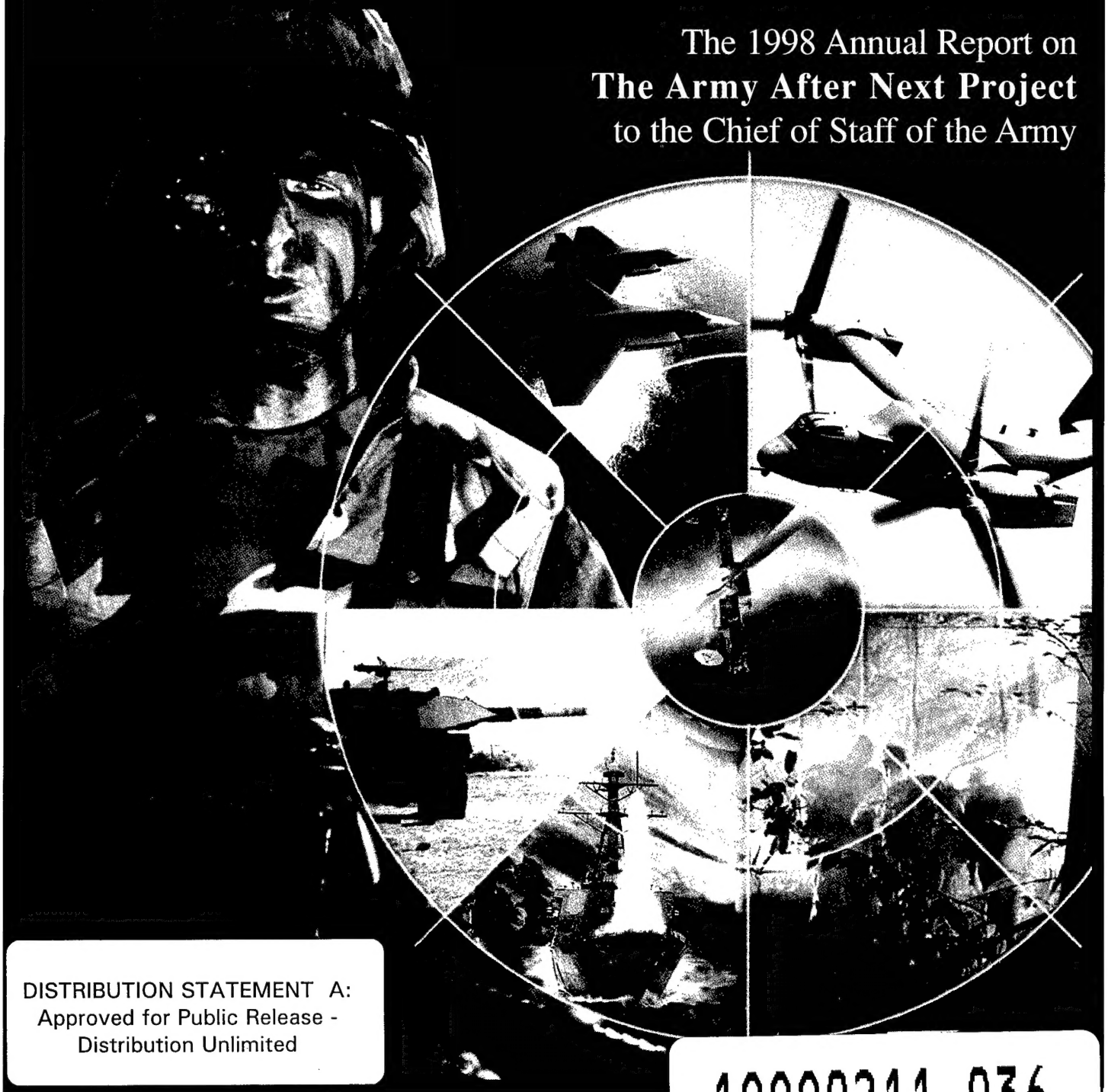
Knowledge and Speed:
Battle Force and the U.S. Army of 2025

The 1998 Annual Report on
The Army After Next Project
to the Chief of Staff of the Army



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December 7, 1998

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UNITED STATES ARMY

THE CHIEF OF STAFF

December 7, 1998

This annual report on the Army After Next (AAN) Project represents more than two years of exploration into the nature of future warfare. It is the product of a pervasive yet rigorous study and research effort to gain insights about tomorrow's geostrategic environment and the strategic, operational, and tactical-level implications for our Army. You will find these insights, as we understand them today, identified and discussed throughout the document.

TRADOC has done an imposing job in leading this effort for our Army and providing us with the intellectual means to think about the long range future. This report captures many important insights. However, this is not a static vision of the future, rather a living document and process that will evolve as does our knowledge of the future. I encourage you to read this report. It is intended to stimulate thought, generate debate and provide a foundation for continued exploration and discovery as we journey toward the future.

DENNIS J. REIMER
General, United States Army
Chief of Staff

Preface

General John N. Abrams
Commander, United States Army Training and Doctrine Command

Enclosed is the second annual report on the Army After Next (AAN) Project. This report captures the insights from this year's investigations into the nature of future warfare with a primary focus on military art and technology. These insights, inclusive of those of the past two years of discovery, provide tremendous benefit to the Army and the Defense Department in a variety of areas. The payoffs of this endeavor are evident in how we are currently shaping Army XXI, in the development of the Army's Experimental Campaign Plan, and in the direction Strike Force development is heading. In particular, the Strike Force is envisioned to embody the concepts and ideas emerging from the AAN process, within the limitations of technology.

AAN is the Total Army. This year's efforts highlighted the enduring need for a hybrid Army of broad and balanced capabilities to enable full-spectrum dominance in a dynamic and challenging operational and threat environment. The operational concepts and forces described here reflect this need and exploit the unique capabilities of the Total Army.

Likewise, while technology is an essential component of possible solutions, the strengths of the American soldier—true grit, ingenuity, and an indomitable spirit—enhanced by advanced technology, are the decisive factors.

While this report builds on previous AAN efforts, this year's undertaking has yielded new discoveries and insights as well as validating those from previous ventures. Nevertheless, it remains an investigative tool to aid the Army as it moves into the twenty-first century. I encourage all to carefully study this document, question its findings, and join in a constructive dialogue to help the Army further define the nature of warfare in the deeper future and prepare for that future now.

Contents

Introduction

The Chief of Staff of the Army established the Army After Next Project in February 1996 "to assist our leadership in developing a vision of future Army requirements." The mission of looking to the future is not a new one. However, the project's 30-year view into the future is unique and decidedly bold.

Since its beginning, the AAN Project has generated creative activity throughout the Army and across the nation. It has matured substantially within two short years; research, conducted within the broad fields of *geopolitics, military art, technology,* and *human and organizational behavior* is already shaping the future Army. The AAN investigation has substantively informed the Strike Force initiative for lethal early-entry forces which, in the near term, seeks to operationalize AAN concepts and build a bridge between Army XXI and AAN.

This past year, AAN studies focused primarily within the fields of *military art* and *technology.* Hence, insights from these endeavors form the core of this report. The intent of this year's efforts was to build upon the principles and concepts laid out in the previous report, *Knowledge and Speed,* which introduced the Battle Force and its capabilities for rapid, decisive maneuver. This report further refines those capabilities. The AAN Battle Force has established the standard for the development of high-end operational and technological capabilities for the Army of 2025.

Army After Next Mission Statement

Conduct broad studies of warfare to about the year 2025 to frame issues vital to the development of the U.S. Army after about 2010 and provide those issues to senior army leadership in a format suitable for integration into TRADOC combat development programs.

This report also further refines several key features of the Army of 2025. That Army will be a hybrid Army. It will consist of a mixture of forces: mechanized and light, forward-deployed and CONUS-based, fully modernized and less modernized, and active and reserve components (AC/RC). It will perform a variety of missions spanning the full spectrum of possible conflict. It will be aided in those missions by a host of technology enablers, many of which are well on their way to becoming realities. AAN studies of future warfare have identified several critical implications for today's Army, implications expressed via the Army's patterns of operations and its imperatives. These two vehicles appear to offer the best means for translating AAN research into a format suitable for integration into combat development programs.

Finally, the report outlines the road ahead. The year 1998 was important for the AAN Project, both in terms of its exploration of vital issues and for the growth and

maturity of the project itself. AAN explorations have provided valuable insights into the wide range of missions the future Army is likely to face. They have shed light on what approaches appear most promising, what long-term preparations and investments must be considered, and what information is needed to better articulate future warfighting requirements. In short, we have gone a long way toward ensuring that the Army of 2025 will serve the nation's needs. This is AAN business.

CSA Guidance

Connect Force XXI, the Army's process of change, to the long-term vision of the Army

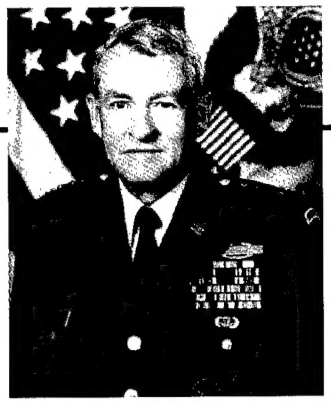
Connect the vision to the Army's research and development programs

Leverage the work already accomplished in the OSD Revolution in Military Affairs (RMA) initiative

Institutionalize the program to ensure continuity and quality of effort

Identify concepts that promote the seamless integration of future AC and RC forces

Think Joint and involve the other services



DENNIS J. REIMER
General, United States Army
Chief of Staff

Discoveries: FY98 Study and Research

THE GEOSTRATEGIC ENVIRONMENT OF 2025

Military operations do not occur within a vacuum, but within a geopolitical context that gives them focus and intensity. Therefore, forecasting tomorrow's geostrategic environment forms the first step in any investigation into future warfare. AAN envisions a dynamic and rapidly changing future geostrategic environment in which the United States remains actively engaged as a world power—a leader in international security and an active promoter of democratic principles, free-market economies, and human rights. Additionally, we expect the rise of one or more major military competitors—modernized states capable of threatening U.S. vital interests or those of our allies within a specific region—rather than a peer competitor with capabilities symmetrical to our own. This complex geopolitical context means that U.S. military forces will execute a wide variety of missions anywhere on the globe. These missions could range from peacetime operations in support of regional alliances to deterrence or defeat of a major military competitor.

AAN research indicates that while the current, multipolar international security system will continue largely intact, tomorrow's world will become increasingly complex, characterized by shifting balances within regions and the prevalence of ad-hoc security structures, vice stable alliances.

Current sources of conflict—ethnic rivalries, nationalism, religion-based antagonisms, and competition for scarce economic resources, including water—will continue and perhaps intensify. Transnational threats such as international crime syndicates, terrorist networks, and drug cartels also have the potential to grow in strength and influence, presenting

security problems that are significantly different from those of the past in terms of scope and quality. A higher incidence of failed states, coupled with the aforementioned sources of conflict and unpredictable natural and human-induced disasters, will likely lead to a rise in regional instability. Maintaining international stability will probably require a higher frequency of action by the international community. As the sole superpower with global reach, the U.S. will retain its current mantle of leadership, but that leadership will become increasingly complex and more difficult to execute.

Given the context above, the principles of peacetime engagement as presented in the current U.S. National Security Strategy have long-term relevance. U.S. interests in the future will be served explicitly by a wide variety of actions intended to contribute to deterrence and conflict prevention. Accordingly, U.S. involvement in peacetime engagement activities and participation in international contingency operations are likely to expand even further beyond the current heavy frequency and scope.

The number of potential security partners for the U.S. will grow as well, although new partnerships will likely be temporary in nature.

At the same time, domestic contingencies—operations in support of civil authorities—are also expected to grow in significance. Indications are that U.S. military forces will play important supporting roles in the future within the U.S. to combat terrorism, to provide disaster relief, to defend against attacks against the environment or national infrastructure, and to control borders. This trend points to a broadening concept within the U.S. regarding the fundamental nature of national security and to the need to integrate DOD and non-DOD agencies more effectively in the future.

THE NATURE OF FUTURE CONFLICT

Although the nature of future conflict is subject to significant change, many fundamental aspects will remain essentially the same. Conflict will take place primarily within the nation-state structure. The range of military operations that has characterized the late twentieth century will hold for the next 25 years, with one exception: great potential exists for the expansion of armed conflict into space and cyberspace.

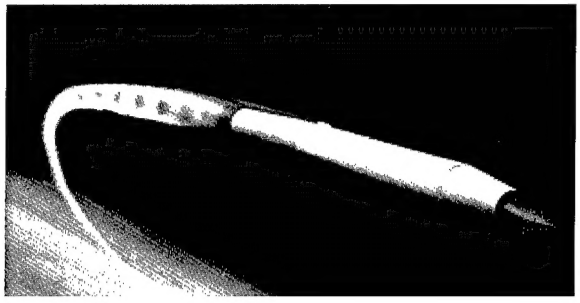
Although no peer competitor to the U.S. is expected to appear, the rise of one or more major competitors is both possible and probable. Major competitors will acquire significant capabilities to challenge the U.S. regionally and, to a selective degree, globally. It is not likely (or rational) that major competitors will seek to match U.S. capabilities across the board as in the Cold War. Instead, by closely monitoring U.S. military developments, major competitors will probably develop creative *asymmetric strategies* and employ *niche capabilities* aimed at avoiding U.S. strengths and capitalizing on U.S. vulnerabilities.

PROLIFERATION

Proliferation of a number of advanced technologies over the next several decades will strengthen the ability of major competitors to dominate regional neighbors, threaten U.S. partners, and endanger deployed U.S. forces. The most threatening of these technologies include:

- Capabilities for precision fires with increased lethality at extended ranges.
- Weapons and technologies (delivered by a variety of means) capable of mass effects.
- Highly accurate medium- and long-range cruise and ballistic missiles.
- Capabilities to enhance C^4ISR through the exploitation of space platforms and the global information infrastructure.

Such widespread proliferation is likely to expand an adversary's reach well beyond immediate territorial objectives and increase the level of lethality and destruction within the future battlespace.



TIME

While *time* has always been important in war, its significance in the future may prove even more critical, particularly with regard to strategic response. Even small delays in strategic response may permit an aggressor to achieve significant aims and to develop a crisis in his favor. Tomorrow as today, our strategic reaction time depends largely upon the ability of the U.S. to project decisive force to the crisis area. Key factors in this equation include strategic warning and situational ambiguity, force deployment and closure times, early-entry lethality and sustainability, success at coalition building, and our domestic political decision-making process. An aggressor's ability to disguise his attacks as accidents, carry them out by proxies, or falsely

tag them to others in some fashion will exploit time and challenge the decision-making process.

Accordingly, one of the most important insights of the AAN Project is that *strategic preclusion* and rapid *strategic maneuver* must form the core concepts for the future joint force. Naturally, the more rapid the U.S. response and the more decisive its capabilities, the more effective its deterrent and preclusive value, and the more likely the prospect of early decision.

Within this context, geography still matters. Despite the development of advanced capabilities and systems, the U.S. will still face challenges in certain areas of the world because of the difficulties geography presents to operational reach and the employment of forces.

SHORT WARS VERSUS LONG WARS

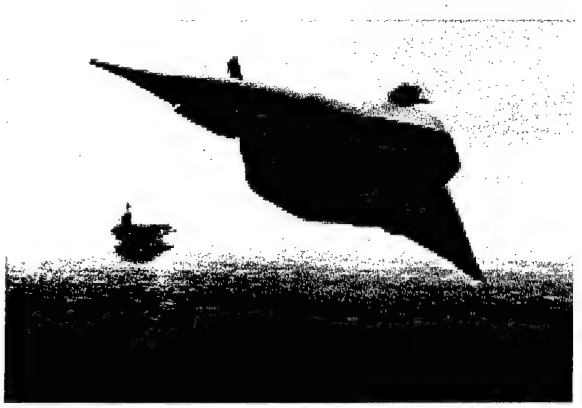
Short decisive campaigns and wars that achieve national objectives are always preferable to long, costly ones. However, short wars and short campaigns are not guaranteed in the future. The first battle will not necessarily be the last. For every Panama and Desert Storm, there is a Korea or Vietnam. Even with very advanced capabilities, it will remain difficult to rapidly defeat resolute, well-prepared adversaries that possess large territories, enjoy sizeable populations, and fight in imaginative or unconventional ways. Moreover, despite the development by the U.S. of capabilities for very rapid power projection, in most cases, the enemy will have the opportunity to move first. Clearly, U.S. joint forces in the future must be equally prepared for the short campaign and the long war.

NATIONAL MILITARY STRATEGY IN 2025

The core elements of the current U.S. National Military Strategy (NMS)—*shape, respond, prepare*—retain long-term relevance to the future geostrategic environment. In 2025, the U.S. military will continue to shape the international security environment in ways favorable to U.S. interests. U.S. forces must be prepared to respond to the full spectrum of crises that affect U.S. interests by deterring aggression, conducting contingency operations, and fighting and winning major theater wars. The U.S. military will also need to prepare for an uncertain future through a focused, deliberate modernization effort. However, a fourth pillar of military strategy will emerge in the future—the need to defend the U.S. homeland against a variety of new threats. Within this simple construct, the U.S. will normally respond to future contingencies as a joint force. Accordingly, interdependence is a central context for examining the role of land power in support of the NMS of 2025.

INTERDEPENDENCE

Many factors will drive the U.S. military toward higher levels of jointness in the future. The proliferation of joint requirements, the increasing frequency of contingency operations, budget pressures, and advances in information technologies will both compel and facilitate greater joint integration. Continuing pressure for greater efficiencies DOD-wide will further motivate the migration of common functions to joint structures, driving out redundancies and nonessential echelons and organizations. By 2025, the boundaries that separate the land, sea, air, and space domains should fade considerably, as jointness leads ultimately to relationships that resemble a seamless continuum of interdependence.



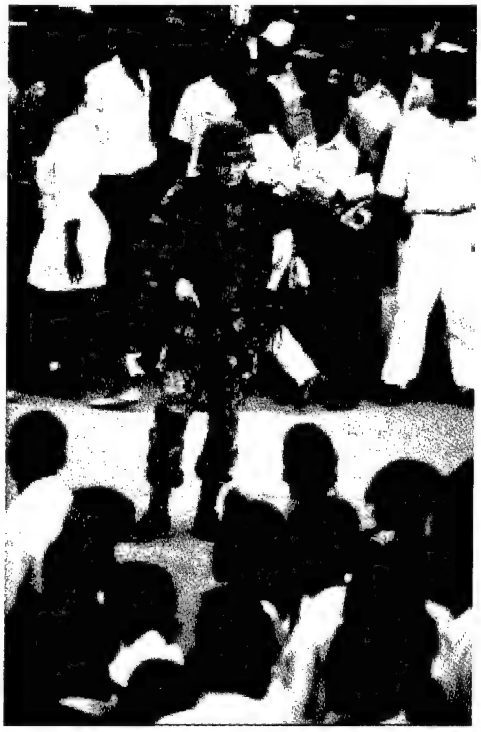
The U.S. Army is thoroughly committed to furthering improvement of joint capabilities. The Army's current dependence on sister Services for many essential functions—lift, fires, communications, intelligence, and sustainment—will increase, not diminish, in the future. Improvements in joint capabilities and joint integration are prerequisites for the Army of the future. Accordingly, the AAN Project has taken deliberate measures to insure that its investigations are carried out within a solid, balanced joint context.

LAND POWER

Even within this context, however, land power will retain an enduring, central significance across the entire range of military operations. That enduring significance rests primarily on two immutable conditions of conflict:

- First, war is the extension of politics by other means; its ultimate aim is to force the enemy to submit. Because political authority resides on land, conflict resolution will most often occur by confronting the enemy political authority on its own territory.
- Second, enforcing a lasting and favorable decision in conflict will require the U.S. military to control people, land, and the resources thereon. Although it is seductive to hope for development of advanced capabilities that will permit the U.S. to carry out relatively simple surgical applications of precision strikes from the safety of stand-off platforms, with little or no collateral damage, both historical evidence and insights from futures experimentation suggests that achieving strategic decision through such means is elusive.

It is also important to note that land power will continue to fulfill its current role as the natural integrator of joint and coalition forces. In other words, future joint expeditionary forces and coalitions will coalesce around the land power component; land power will be the common core for most contingencies across the spectrum of conflict, particularly with partners who do not possess significant air, sea, or space capabilities.



Shape

AAN research has consistently validated the continuing relevance of peacetime engagement activities for shaping the environment in 2025 in a manner supportive of U.S. national and military interests. Activities ongoing today, such as military-to-military contacts, port visits,

sister-unit relationships, combined exercises/training, security assistance, foreign military sales, and interoperability, will retain significance for the future. Joint regional engagement forces, consisting of forward-stationed, forward-deployed (for training), and special operations forces, will be needed to execute CINC regional engagement objectives. Over time, these activities will foster stability and help build the political and operational foundation needed for coalition effectiveness and regional support for U.S. contingency operations.

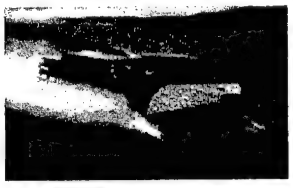
However, the AAN Project has also surfaced several future concerns. First, considering the growing complexity of coalition operations and the potential number of U.S. partners, the level and pace of engagement activity needed to establish a basis for effective combined operations will likely increase. Second, recent reductions of the number of U.S. forward-stationed and forward-presence forces will either need to be reversed or new approaches developed to sustain this increased engagement. Third, the technological differential between U.S. and foreign forces will present a greater obstacle to meaningful cooperation in 2025 than it does today.

Peacetime engagement will continue to be largely land power-centric in 2025 for the same reason it is so today: Most (but not all) U.S. regional partners in the future will maintain armed forces based primarily on ground forces. Only a few will be able to afford or field significant air and naval forces. As a result the Army's role in peacetime engagement will remain critical. The future Army will need to apply its resources carefully to this mission area over the long term in order to reap the best return. However, finding the proper balance between resources and requirements may be difficult, given other operational and readiness requirements; shortfalls in time and resources to devote to engagement may be inevitable. AAN research suggests that Army special operations forces (ARSOF), as part of the joint regional engagement force, may be a central means for redressing this imbalance. That role is described in more detail below.

Respond

The U.S. will respond to future contingencies through its capabilities for joint power projection. Current concepts of deterrence, overseas presence, and power projection will be elevated by advanced capabilities for strategic response.

The fundamental challenge facing military planners, once the National Command Authorities (NCA) decide to use military force, is the race to establish military capability in the troubled theater. Efforts to resolve the crisis short of war will almost certainly cede the initial military initiative and advantage to the enemy. As U.S. or allied/coalition forward-presence forces are reinforced first with early-entry capabilities, then by more enduring and lethal capabilities over time, leadership seeks to wrest the initiative from the enemy and move toward an enforced and favorable decision.

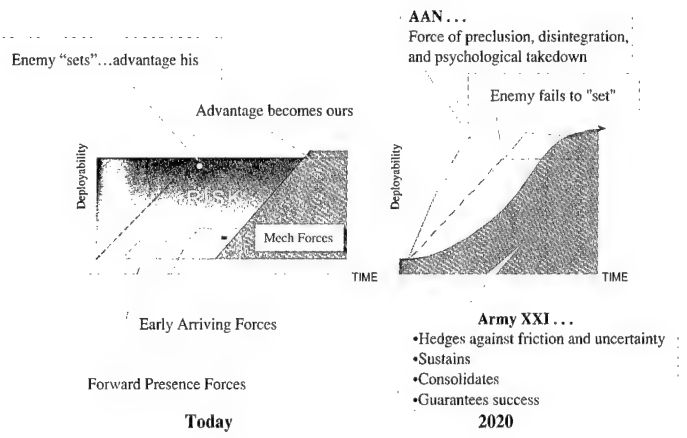


Regional Engagement Forces support deploying forces by:

- Adding to the knowledge base
- Empowering allies
- Disrupting enemy operations
- Enhancing force projection

Regional engagement operations perform a critical shaping function that enables the precision focus and tempo essential to effective AAN operations

The answer to the challenge is strategic preclusion. Strategic preclusion is the idea of moving so fast and with such lethality that enemies cannot



Future power projection will allow AAN forces to start decisive action before the enemy sets. Decision will be assured through seamless integration with Army XXI forces.

Possessing a wide range of advanced, flexible, highly lethal capabilities, seamlessly integrated across the domains of air, land, sea, and space, the JEF commander applies strategic maneuver and strategic fires to compel the enemy to submit. The key to success is the simultaneous, balanced, and mutually supporting application of strategic maneuver and strategic fires to achieve a synergy that exceeds the effect of either applied alone.

"set" forces and operate at advantage. In the best of cases, this response would be decisive in its own right, settling the issue quickly and with minimal loss of life and property. At a minimum, its rapid arrival in theater would fundamentally alter the relationship of forces within the battlespace to our advantage and set the conditions for the timely integration of additional forces that would ensure favorable decision. Optimally, the recognized capability to execute strategic preclusion would have the effect of discouraging would-be aggressors from creating such crises in the first place.

Strategic Preclusion. Strategic preclusion will be achieved by the Joint Expeditionary Force (JEF), a 2025 full-dimension force comprised of modular and tailorable early-entry ground forces operating in conjunction with collective air, sea, space, and special forces assets. Effective preclusion will require a refined level of synchronization across the entire force, combining the effects of joint precision strike and air-sea dominance with exploitative maneuver and contributing fire/strike from ground forces to dominate territory and the enemy.

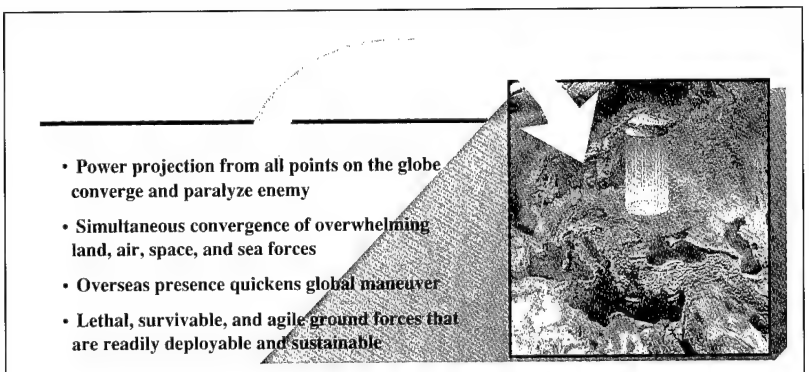
Advanced full-dimensional operations are the means by which the JEF achieves strategic preclusion and conflict termination, accomplishing the political objectives for which the NCA launched military operations.

Strategic Maneuver. Strategic maneuver circa 2025 envisions rapid movement over global distances of highly lethal air, land, sea, and space capabilities to converge with overwhelming power upon the enemy centers of gravity and then to cause the rapid disintegration of the opponent. Strategic maneuver seeks to use positional advantage to change the conditions of battle by seizing the initiative and creating new battlespace relationships. Ideally, only two choices are left to an enemy: engage knowing he is destined to lose or abstain from further conflict on terms favorable to the U.S. At a minimum, by delivering decisive power rapidly, strategic maneuver will mitigate risk at the front end of a campaign and help to create conditions for early termination.

The concept envisions movement of combat power from garrisons, through intermediate staging bases, directly into combat, with time-lines compressed from weeks and months to days. Ideally, AAN desires to free the Army from the current pattern of sequenced, linear movements from garrison to port-to-port to staging area, accomplished over an appreciable time frame, extended by a lengthy build-up phase of combat power prior to the initiation of offensive action.

Strategic Fires and Interdiction. Strategic fires and interdiction make up the other critical component of advanced full-dimensional

operations. Applied in conjunction with strategic maneuver, strategic fires use precision and area effects to destroy critical enemy capabilities and deny his ability to prosecute his intended campaign. As the JEF approaches the theater, strategic suppression and lethal precision strike will be targeted against enemy precision, air defense, and C^4ISR capabilities employing space-based laser and kinetic systems, long-range missiles armed with smart submunitions, ultralong-range "continental artillery," and supporting IO assets. Once in theater, JEF land components join air and sea components with both short- and long-range capabilities. Provided a protective umbrella for maneuver through this strategic shaping operation, Army contingency forces exploit these fires and apply organic long-shooters to the mix. Optimum effects will be achieved and resources conserved through the operation of a joint fire control system, fully empowered by real-time targeting/battle damage assessment (BDA) and automated allocation systems.



The goal of strategic maneuver is a globally deployable force capable of controlling strategic and operational centers of gravity, leaving the enemy with only two choices: fight and lose or abstain and concede to our terms.

Major Campaigns. While the goal of military operations is the rapid and decisive application of force to achieve NCA objectives with quick conflict termination, a resourceful and dedicated foe may force an extended campaign. In such situations, quantity continues to have a quality all its own. National air, land, sea, and space capabilities must be robust enough to support unilateral strategic maneuver and fires to successful campaign termination. In situations of extended duration, the future Army will provide unique capabilities for sustained operations on land, for which there is no air-, sea-, or space-based substitute. In addition, once conflict termination is achieved, sustained presence by land power will provide the stability and security required for long-term resolution through the political process.

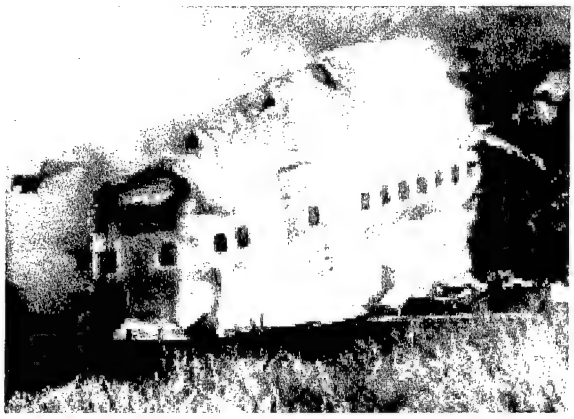
At the lower end of the spectrum, land power will play a dominant role in operations intended to reassure and support regional allies and partners. In fact, U.S. commitment of operationally significant ground forces, signifying American willingness to bear both burden and risk inherent in any contingency, will often function as the political glue that binds the coalition together. Only land power offers the flexibility and range of possible responses required to modulate the application of force in contingencies that will range from the benign to the extreme.

Defend

Maintaining a strategic nuclear deterrent will continue to be the nation's most pressing defense requirement in 2025. Close behind will be the increasingly important requirement to maintain an effective national missile defense. As noted previously, a third requirement—homeland defense—has emerged as a first-priority asymmetric challenge.

AAN research indicates that future adversaries will devote significant resources to attacks against the American homeland for their anticipated effects on public opinion and political will. Further our enemies will pursue the destruction or degradation of specific elements of national power essential to support of deployed forces.

The requirements of *homeland defense* will extend well beyond DOD. Constitutional, legislative, and practical restrictions will probably relegate U.S. military forces to a supportive, yet critical, relationship with other government agencies and elements within society. Serious questions regarding authority, relationships between governmental agencies, control of National Guard forces, and cooperation with the commercial and private sectors must be resolved. Effective integration of the large number of participating agencies faces



formidable obstacles in terms of differing institutional cultures, low technical and procedural interoperability, and the absence of a common vision. Just the single task of achieving common situational awareness over the entire breadth of U.S. territory is a daunting C^4I challenge that could consume critical resources previously dedicated to OCONUS operations.

At present, it seems clear that homeland defense operations will bear little resemblance to traditional military operations. The AAN Project will devote a more focused effort in FY99 to investigate further the potential roles, missions, and capabilities required for Army participation in this increasingly critical area

THE CHARACTER OF MILITARY OPERATIONS IN 2025

The proliferation of advanced technologies over the next several decades will have a profound effect on military art and the 2025 battlespace. More specifically, the combination of advances in battlespace awareness, precision fires, lethality, engagement ranges, and streamlined logistics, coupled with revolutionary information-based capabilities to integrate operations multi-dimensionally in real time and space, will make the battlespace a far more deadly place and fundamentally alter the relationships between fire, movement, and protection. Significant advances in the development of precision-fire capabilities compared to relatively modest progress in our ability to move complex military formations will challenge us to regain and maintain maneuver capability within a precision strike environment.

THE 2025 BATTLESPACE

AAN research and Force XXI experimentation indicate that the twentieth century combat paradigm of fixed lines with tied-in flanks, largely secure rear areas, echeloned formations, deliberately phased operations, and direct-fire engagements executed by large maneuvering formations is subject to radical change. The future battlespace will have few or no sanctuaries; forces deployed

to any region in the theater will be vulnerable to a blend of conventional and unconventional attack by air, missiles, information operations (IO), special operations forces (SOF), and, potentially, space-based weapons. Mass and shock will be achieved by massing and integrating the effects, in a short period of time, of variable range fires from a wide variety of air-, ground-, and sea-based platforms. Non-line-of-sight (NLOS) systems will exert an influence on battlefield outcomes far greater than that of direct-fire systems.

Overall, these kinds of developments will greatly strengthen the defense, creating conditions wherein offensive action based on large-scale maneuver will entail considerable risk to piecemeal destruction from a fire storm of precision munitions. In fact, extended maneuver will likely be possible only under two conditions:

- Serious degradation of one or more components of the enemy's precision system (particularly the information-based components of that system).
- Sharp increases in the mobility and speed of the maneuvering formations.

As a result, the 2025 battlespace will largely be characterized by widely separated forces and noncontiguous areas of operations. U.S. forces will identify and engage key elements of the enemy forces within the battlespace, employing an integrated mix of joint fires and rapid maneuver, optimized by objective and time. Distributed operations will be decentralized in execution, but carried out in accordance with a centralized, fully integrated joint plan, which is both orchestrated and supported by a pervasive and resilient C^4I network. The tempo of operations will increase sharply, as tactical objectives are achieved in remarkably short bursts of time. Tactical successes, piled up nearly simultaneously across the entire battlespace, could then lead under the right circumstances to rapid operational-level disintegration as the enemy's plans are first foiled and then shattered—even as his ability to control his own forces evaporates before he can respond.

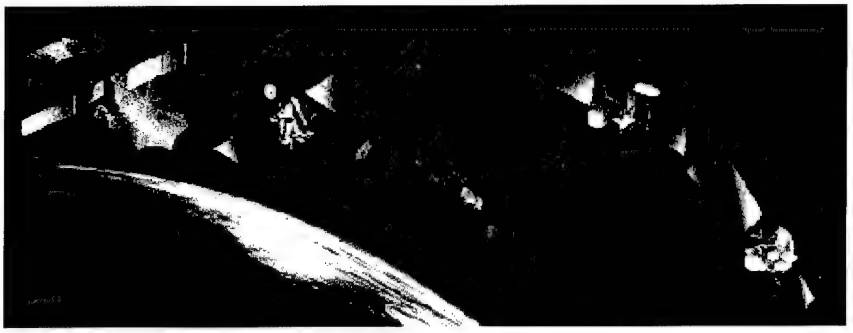
Maintaining dominance across the air-, land-, sea-, space-, and cyber-domains will be essential prerequisites to achieving this level of sophisticated interaction. Two broad capabilities will form the foundation for this dominance: knowledge and speed.

Knowledge encompasses battlespace information and situational awareness, i.e., that knowledge about one's own forces, other friendly forces, and the enemy's forces essential to battle effectiveness. As the primary and universal enabler for virtually all battlespace functions during all phases of conflict, knowledge is paramount; it affects everything. Conversely, absent sufficient knowledge, everything is at risk. Although uncertainty will certainly remain a feature of future war, the unprecedented level of battlespace awareness that is expected to be available will significantly reduce both fog and friction.

Knowledge will shape the battlespace and create conditions for success. It will permit the distributed, decentralized, noncontiguous operations described earlier. It will provide security and reduce risk. Through the identification of enemy strengths, weaknesses, and centers of gravity, coupled with near complete visibility of friendly force status and capabilities, knowledge will underwrite the most efficient application of all elements of military power—enabling higher tempos of operations. Knowledge will also focus and streamline the logistics support required to maintain high tempos.

In 2025, knowledge will be obtained from a largely space-based "living internet" of a jointly-integrated, multilayered C^4ISR system of systems that permits the fusion of information products from a variety of sources, from national to tactical level. Employing automated filters and continuously updated feeds, fusion creates a coherent, near real time, common picture of the battlespace essential to support battle command across the entire theater and within all components of the JEF.

Given the overwhelming significance of knowledge systems to battle outcomes, achieving and maintaining information dominance over the enemy will be an absolute imperative for rapid decision in future battle. Accordingly, the vulnerability of the various components of the constellation of systems that comprise the living

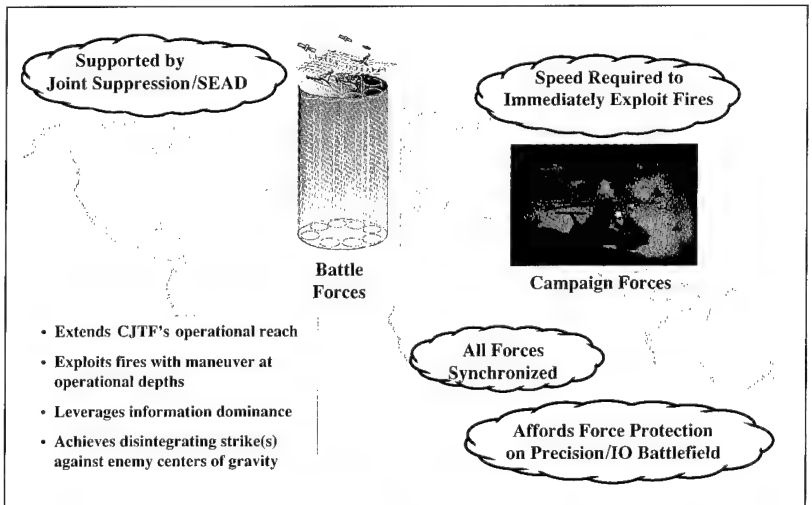


internet, a vulnerability demonstrated in every AAN wargame over the past two years, will demand comprehensive protective measures, particularly for space-based platforms. In addition, redundancy will be indispensable. It will be obtained through multiple layers of sensors and communications routes, plus inherent capability for rapid reconstitution of layers or components taken out by enemy action.

The purpose of speed is to manipulate time and space to one's advantage, relative to the opponent. Moreover, if knowledge provides mental agility, then speed will provide the physical agility needed to capitalize on superior knowledge. Significant improvement in mobility and speed of movement is essential at all three levels of war to meet the requirements of future battle.

At the tactical level, AAN research indicates that speed must increase by a factor of two or more to overcome the strength of a knowledge- and precision-based defense. Movement speeds within that range will seriously complicate enemy target acquisition, reduce exposure to fires, enhance massing of effects, facilitate rapid resupply, and permit the deployed force to reconfigure rapidly for subsequent operations. However, achieving this level of improvement will only be possible by rotating the traditional two-dimensional orientation of ground forces into the vertical dimension. Some form of theater/tactical airlifter—whether that be a vertical takeoff and landing (VTOL), super-short takeoff and landing (SSTOL), or Joint Transport Rotor (JTR)—must be developed and fielded in considerable numbers to obtain this breakthrough in ground force speed. However, only a part of the future land power component requires a high-speed near-vertical maneuver capability, not the entire force. Even though improved, Army XXI campaign forces will still be relatively burdened by a significant logistics tether and will largely retain a horizontal perspective and move at a much slower pace. Discovering the most effective combinations of high-speed and lower-speed elements remains an AAN objective for future investigation.

Coupling superior speed and knowledge with range of operations provides the joint force commander with extended operational reach, i.e., the capability to project near vertically maneuvered Strike Forces against specific objectives at operational depths. Superior speed at tactical and operational levels also permits the advantaged side to more fully exploit the effects of its long-range fires and to reposition quickly. Speed, knowledge, and operational reach



Vertical envelopment allows the commander to selectively use ground for tactical advantage without relying on it for mobility

further combine to present a qualitatively new capability; i.e., the near simultaneous application of combat power against key elements within the enemy's entire zone of operations. Sequenced operations will not disappear, but evidence suggests that phases and sequential operations can be compressed in time. Certainly, superior speed, knowledge, reach, and simultaneity are all necessary to achieve operational disintegration.

At the strategic level, if JEFs are to achieve strategic preclusion, they must be projected quickly. Instead of weeks and months (Desert Storm), the joint forces of the future will need to move from staging points to combat positions within a matter of days.

THE ARMY OF 2025—A HYBRID FORCE

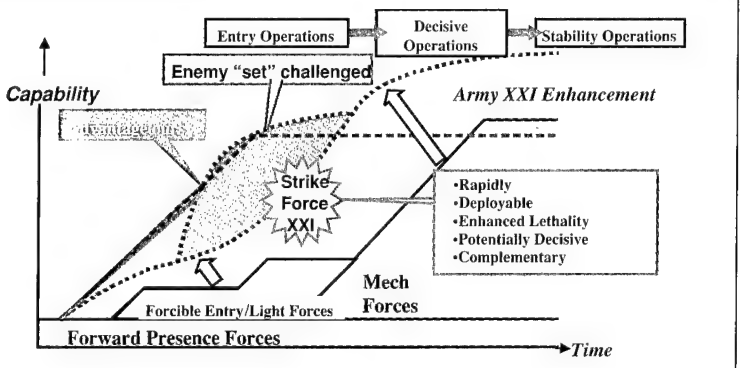
During the twentieth century, the Army has always gone into a battle with a blend of dissimilar forces fighting side-by-side. Given the costs of modernization, the tyranny of developmental/acquisition time lines, and the unpredictability of technological breakthroughs, the fielding of a hybrid force is both unavoidable and entirely appropriate. However, the differences inherent within the Army of 2025 will likely be more pronounced and more visible than today due to the capability gap that will exist between elements of the force equipped with current and emerging technologies (evolutionary) and those equipped with leap-ahead technologies (revolutionary). The hybrid force of 2025 will be forged from a range of functions, force structures, and capabilities spanning 20-25 years, from modernized AOE organizations to AAN Battle Forces, each optimized for a specific set of missions and circumstances, but adaptable to meet a broad range of conditions. Leap-ahead advances in power, fuels, and materials will help narrow the capability gap between light and mechanized forces while open architectures will provide a built-in capability to upgrade and modernize. Light forces will have greater capability to operate in mid-intensity environments, while mechanized forces will have the flexibility to accept hand-off from contingency forces to conduct stability operations. Similarly, modularity will permit combinations of light, mechanized, and SOF to operate effectively and complement each other in complex terrain. Contingency forces will dispose sufficient staying power to hold or advance until reinforced by later arriving, heavier forces better suited to achieve decision. In short, deployed forces will have the inherent robustness in capability to respond broadly to a changing set of conditions across the operational continuum.

At present, for the purposes of wargaming and investigation of future conflict, the AAN Project forecasts a 2025 Army comprised of four main elements:

- Contingency Forces consisting of Battle Forces, Strike Forces, light and selected mechanized forces
- Campaign Forces
- Homeland Defense Forces
- SOF

Contingency forces operate as part of a JEF. JEF ground forces will consist of a combination of modular and tailorable brigade-, division-, or corps-sized Battle, Strike, and light and mechanized forces operating in conjunction with like-tailored air, land, sea, and SOF. Contingency forces offer the JEF commander capabilities ranging from deep strike to the ability to assault and reduce an enemy fortified within complex terrain. Elements of the contingency force will have the ability to conduct combat operations for limited periods without resupply. Melding the sustainment capabilities of SOF and Battle/Strike Forces with host nation and/or coalition support will broaden that capability and help ensure reliable, long-term protection of logistical and support areas.

Battle Forces will be the most modernized element within the hybrid force. They are designed around revolutionary capabilities and concepts enabled by leap-ahead technologies. Employing some degree of self-deployment capability, coupled with ultrafast strategic lift, Battle Forces will execute strategic preclusion



Designed for early entry intervention – can deter, stabilize, influence, and shape by leveraging improved strategic mobility and lethality
Optimized for maneuver warfare -- Capable of decisive action --Joint to interdependence– Maneuverable and lethal -- Establishes information dominance– Seizes operational initiative

Strike force enhances landpower projection by 2010; allows for early move toward AAN operational concept within constraints of near-term budgets and technologies.

and strategic maneuver. Following early entry, these forces conduct vertical or near-vertical maneuver to operational depths and pose the greatest threat to enemy maneuver formations.

Strike Forces complement Battle Forces and strongly augment the Army's early-entry capability in 2025. The Strike Force is envisioned as a medium-weight force disposing evolutionary technologies and capabilities available for initial fielding in the 2005-2010 time frame. Comprised of smaller, lighter units than currently exist in the mechanized force and requiring reduced logistics support, the Strike Force will deploy more rapidly. It will possesses capabilities for tactical mobility, speed, and depth of operations that exceed current forces; will combine greater lethality and survivability than light forces; and will complement Battle Forces during early-entry operations. Its medium weight, survivability, and lethality will provide power for both shock and resilience and make it well suited for executing early-entry and shaping operations.

Other contingency forces include light forces optimized for opposed entry, complex terrain, and special missions and selected mechanized forces to provide weight or rapid reinforcement of the early-entry forces.

Army XXI programmed forces of today, product-improved over time, are the campaign forces of the future. These forces will employ modernized C^4ISR capabilities but will be equipped mainly with technologies and capabilities evolved from the current force. They will be supported by a robust logistics structure due to their heavy sustainment requirements for fuel and ammunition. Accordingly, campaign forces require considerably more time to deploy, and they will consume the major portion of the nation's strategic lift capabilities. Campaign forces may include AC units forward deployed and routinely involved in peacetime engagement operations.

Campaign forces follow contingency forces into the theater as rapidly as possible, providing weight, flexibility, and the critical mass to ensure achievement of a favorable decision. They will be optimized for extended campaigns against stubborn, strong-point defenses. Moreover, the threat of their arrival will apply additional pressure against the enemy to capitulate more quickly. Finally, campaign forces will be best suited for participation in long-term stability operations. RC units may also make up a significant portion of campaign forces committed to extended stability operations. The Army of 2025 will depend on an exceptionally high degree of integration between AC and RC forces for contingency operations. RC units will deploy early and in significant numbers to fill gaps and perform essential functions not resident within the AC.

Homeland defense forces consist mainly of RC units. Their distribution throughout the homeland and the relationships they have established over time with local and state officials make them particularly well suited for this mission. Advanced C^4ISR capabilities that link a wide range of agencies in accordance with coordinated policies, processes, and organizational arrangements are vital for this

mission. In addition, information-based advances in training and strong direct linkages with AC forces provide means for raising routine readiness levels within the RC. This improved performance potential will facilitate the shifting of RC forces from Homeland Defense duties to reinforce campaign forces when situations require sustained operations and greater force concentrations.

ARSOF will provide a broad sweep of unique capabilities across the entire range of future military operations. Given the expected spread of regional instability and the corresponding rise in significance of coalition operations, the need and utility of ARSOF as a core component of regional engagement forces may rise sharply in the future. Additionally, regional special operations commands may provide the core command/staff elements needed for very rapid establishment of joint task forces to respond to lower end contingencies.

Differences in capabilities between the elements of the hybrid force will be accommodated through fully integrated operational concepts. All elements will share common information capabilities and be fully integrated within the living internet. All will benefit from a common picture of the battlefield, and all will be capable of calling on reach-out capabilities resident elsewhere within the JEF. Combining its separate elements to meet the changing conditions of the battlespace, the

hybrid force will be the durable, flexible, and fully adaptive land power force required to achieve decision in 2025 spanning the full spectrum of conflict.

The AAN Project invested much of its energy on examining just how the hybrid force might actually operate in the world of 2025. The results of that examination are reported in the following section. Additional insights gained through AAN franchise investigations are included in Annex B, AAN Franchise Reports.

PATTERNS OF OPERATIONS

As described in TRADOC's *Land Combat in the 21st Century,* the "Patterns of Operations" provide a comprehensive and coherent construct for exploring the character of future military operations across the spectrum of conflict.

The six patterns are mutually supportive and nonsequential. They are conducted simultaneously and continuously through all phases of conflict. As such, they provide an appropriate analytical means for presenting the operational insights gleaned from AAN investigations over the past two years.

Patterns of Operations

Project the Force

Protect the Force

Gain Information Dominance

Shape the Environment; Set Conditions for Success

Conduct Decisive Operations

Sustain the Force

PROJECT THE FORCE

This report noted earlier that joint power projection, strategic preclusion, and strategic maneuver should be core concepts for the future joint force. Several key challenges must be resolved to insure that these capabilities are available to the NCA to craft flexible strategic responses.

Strategic maneuver by land forces depends first and foremost on the development of advanced deployment platforms: ultraheavy airlifters and high-speed ships capable of operating over shore or through undeveloped port facilities. Future adversaries must not be able to stymie U.S. strategic deployments simply by denying access to theater port facilities. A point-to-point versus port-to-port approach will provide the most flexibility and protection.

Some Army contingency forces should possess a limited capability for self-deployment by means of an organic lifter, which current projections suggest may be developed on the basis of a fiscally feasible SSTOL design. Self-deployment will reduce the burden on strategic deployment platforms, expand the number of approaches into the theater, and provide an enormous degree of operational flexibility, enabling Army forces to appear virtually anywhere in the battlespace in a matter of days. Overall, however, the primary responsibility for projecting the Army of 2025 will rest solidly on advanced deployment capabilities resident in the U.S. Air Force and Navy.

Lightening Army forces will expedite throughput and provide additional operational agility. The most critical areas for improvement include:

- Reduction in the size of units.
- Weight reduction for ground combat platforms.
- Reduction of support processes and structures.
- Reductions in logistical requirements, particularly fuel and ammunition.

The last point deserves special consideration. As CASCOM notes in its annual AAN franchise report (see Annex B), "the AAN force will not be lightened by any significant degree unless major improvements are made in the areas of fuel and ammunition [requirements]."

Strategic maneuver also depends on advanced C^4ISR capabilities. Forces moving directly from garrison into active operations must have the capability for en route planning, analysis, simulation-based training, and mission rehearsal. AAN research points to primary dependence on space-based capabilities for these functions, as well as for uninterrupted communications, navigation, and positioning for deploying forces. Some of these en route functions can be embedded in command platforms and updated remotely.

Forward stationing and pre-positioning remain manifest requirements for joint strategic maneuver. Forward-stationed forces and pre-positioned equipment and supplies will contribute to deterrence, provide more proximate assets for preclusion, enhance reception, staging, onward movement, and integration (RSOI) for forces projected from CONUS, and, in general, decrease the time needed for a decisive U.S. response.

The variable composition of the hybrid force presents some particularly difficult problems regarding force closure. Although contingency forces will be deployed rapidly, delivering the heavy volumes and weights associated with Army XXI campaign forces to the theater will require considerably more time, creating gaps in the force closure sequence. Force closure gaps can lead to significant vulnerability for early-entry forces, can compromise the effectiveness of AAN Battle Forces, can hinder operational disintegration, and can forfeit opportunities for early termination of the conflict. Campaign forces must be available in time to reinforce and provide decisive weight to operations initiated by early-entry forces and SOF. Critical injections of RC units must also be melded seamlessly into the flow.

Two other concluding points are noteworthy. First, AAN research indicates that infrastructure for intermediate staging bases is critical for effective strategic maneuver. Deploying forces, particularly those moving by air, must be able to pause en route to refuel, link up with pre-positioned equipment and supplies, and transition through nodes along multiple strategic approaches. Second, contingency forces must be accompanied (or preceded) by an early projection of sustainability and information dominance capabilities.

PROTECT THE FORCE

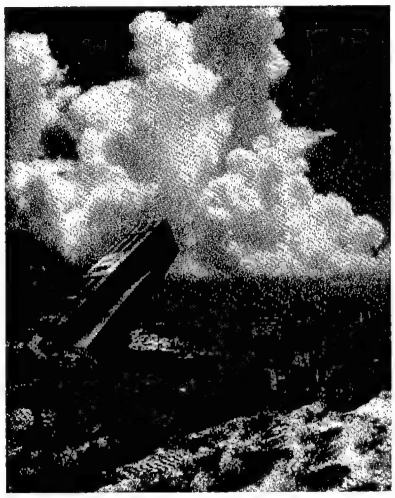
U.S. planning to protect its forces in the future will be seriously complicated by an expanded array of threats exploiting the proliferation of advanced military technologies available in the marketplace. Ambiguity regarding sources of attack, unconventional agents, and rules of engagement (ROE) present additional obstacles. Vulnerability will exist from barracks to foxhole. Forces at rest or in motion anywhere could find themselves at risk. The high value of knowledge in this environment bears close scrutiny. Peacetime intelligence efforts will likely have to improve significantly to provide early warning and visibility over emerging capabilities, methods, and plans of potential adversaries. Once conflict begins, U.S. forces will need to exploit all available intelligence sources, including civilian organizations. Regional engagement forces can also play an important role as "global scouts" in helping to define and prepare for specific regional threats.

AAN emphasis on power projection during the past year demonstrated the clear vulnerability of the deployment process and infrastructure to disruptive attacks by a determined adversary. During the Spring Wargame (SWG), Red strategy explicitly called for an ambitious campaign of deployment denial. Red attacked the entire infrastructure, including ports, airfields, OCONUS staging bases, lift assets, fuel supplies, and the information systems and software used to control deployment. The small delays created by this campaign had significant operational consequences favorable to the enemy. Clearly, the power-projection posture of the Army of 2025 will demand comprehensive efforts to protect the force.

Cruise and Ballistic Missile Defense

U.S. forces must have that capability to defeat enemy ballistic and cruise missile attacks. Moreover, that umbrella must expand rapidly as required to provide protection to regional partners and vital assets. Successful enemy strikes against ports and airfields, intermediate staging bases, forces, or other critical assets could seriously affect the ability of the U.S. to execute strategic maneuver. Failure to protect against missile strikes will have a negative effect on coalition cohesion and the entire AAN operational construct. For U.S. joint forces in 2025, few technological challenges will be as important as creating an effective missile defense.

U.S. forces must also be prepared to protect against the use of weapons of mass destruction (WMD) delivered by a variety of overt and covert means. Given adversaries that view WMD weapons as a means of compensating for U.S. advantages in other capabilities, the future operating environment is likely to include many areas contaminated by nuclear, biological, or chemical agents.



Space Defense

The vulnerability of space-based platforms, highlighted in last year's report, remains a high-level concern. Multiple means of attack will be available to a determined adversary, including kinetic kill, electronic interference, air- and space-based lasers, radiation bursts from nuclear strikes, and the deliberate creation of space

debris. In addition, the terrestrial components of the Global Information Environment (GIE) also provide lucrative targets for conventional and unconventional attack; the nonmilitary terrestrial components are particularly soft. Redundancy at all levels is an absolute requirement; rapid reconstitution of the space constellation through redeployment or new launches is desirable. Future preparations by the U.S. government to protect its space capabilities will undoubtedly be extended to some degree to the civilian sector. No simple solutions exist; extraordinary efforts will be required to protect this vital C^4ISR pillar.

GAIN INFORMATION DOMINANCE

Information dominance is the ability to collect, process, and disseminate an uninterrupted flow of information, while exploiting or denying an adversary's ability to do the same. Both elements are equally important to battle outcomes. In future war, the side able to achieve and maintain information dominance will have a decided, perhaps decisive, advantage over its opponent. AAN research has yielded some valuable insights in this area.

First, the struggle to maintain an information advantage will be a continuous effort, not a constant advantage. The hybrid Army and its joint and coalition partners must know when they possess information dominance, and when they do not. They must be able to operate under conditions of degraded C^4ISR capability. Surge efforts will likely be required to insure that dominance is maintained during critical phases.

AAN research also demonstrates that exercising information dominance is a complex activity that is still understood at only a rudimentary level. A need exists for national policy regarding core issues of control, release authority, and ROE. IO campaign plans produced at national, theater CINC, and JEF levels will need to be fully integrated to optimize effectiveness. In addition, it is not clear who should control theater-deployed space-control assets—CINCSPACE or the theater CINC fighting the war. More work is required to develop the knowledge and experience needed to understand how the IO tools of the future can be best employed. Finally, how to defend against the many threats to national and theater information infrastructures is only dimly understood at this time.

The interrelationship of military and commercial information capabilities also requires more investigation. By 2025, most of the GIE infrastructure will be commercially owned and operated from space platforms. As a result, commercial and third-party intelligence, surveillance, and reconnaissance (ISR) will be available to virtually anyone, including adversaries. The U.S. military itself will be highly dependent on commercial capabilities to provide a significant degree of the uninterrupted, overlapping functional (communications, navigation/ positioning, ISR, etc.) and territorial coverage needed in the battlespace. DOD may need to consider measures to "applique" certain active and passive enhancements to commercial systems, perhaps through collaborative design, appropriate to satisfy military requirements without degrading commercial viability.

Deployed forces must achieve effective situational awareness even if space-based capabilities are degraded. Accordingly, non-space assets at the tactical and operational levels remain essential for redundancy, flexibility, and comprehensive, uninterrupted coverage. Among these assets, unmanned aerial vehicles (UAV) in their multiple variants hold particular promise. The Army's current emphasis on UAV technology and the operational and organizational concepts associated with those capabilities are timely and well-placed.

Finally, it is true that while information is good, knowledge is better. Vast quantities of information from civilian, interagency, joint, combined, and tactical sources will pour into the command centers of deployed forces. Achieving information dominance requires that this flood of information be precisely and automatically focused, fused, distributed, and displayed in the form most appropriate to the user. Highly advanced information processing, employing automated filters, decision support aids, and comparative analysis and distributed by multiple communications routes, will be the

means by which information is turned quickly into knowledge. Speed and quality of decision making for current and subsequent operations are the ultimate outputs.

As the U.S. becomes increasingly dependent on information and knowledge for focusing power, particularly in military operations, the protection of the ability to collect, process, archive, and disseminate information becomes an evermore essential and complex enterprise. Therefore, a comprehensive capability (technical and procedural) for information protection, both active and passive, are vital to maintaining an uninterrupted information exchange.

SHAPE THE ENVIRONMENT AND SET CONDITIONS FOR SUCCESS

Shaping operations are conducted in peacetime and war to set the conditions for success by reducing the enemy's options and exposing him more fully to friendly capabilities. Ultimately, shaping operations facilitate decisive operations.

ARSOF are likely to play a key role in shaping the environment in peacetime. Given their regional expertise, multicultural immersion, and knowledge of foreign environments, coupled with familiarity with U.S. capabilities and concepts, ARSOF are uniquely qualified for regional engagement. The presence of ARSOF on the ground prior to a conflict will provide the JEF commander with a tremendous resource, both in terms of strategic assessment and capability for action in support of deploying forces.

Engagement activities will also pay off in expediting arrangements to establish ad hoc coalitions, reaching agreement on conflict objectives and end states, and facilitating overflight or transit rights, stationing privileges, and other forms of support critical to U.S. strategic maneuver. In addition, regional engagement forces may establish operational and technical linkages between U.S. and coalition forces, perhaps making it possible for early exploitation of U.S. capabilities (IO, strike, SOF) on behalf of a threatened ally.

As a conflict becomes imminent in 2025, the battle environment can be shaped further by a variety of flexible deterrent options. Demonstrations of U.S. space, information, strike, and SOF capabilities to target, but not strike, critical assets or otherwise degrade/destroy key enemy capabilities may cause an enemy to pause. The early deployment of any element or combination of elements within the JEF to more proximate positions would certainly close off many enemy options. Prompt establishment of a reliable theater missile-defense umbrella would sharply blunt the threat of enemy missile strikes

The enemy, of course, will also attempt to shape the battlespace to his advantage prior to conflict through covert preparations, measures to reduce exposure to U.S. capabilities, and protection of critical assets and resources. Consonant with a strategy of asymmetry, the enemy will also pre-position assets such as SOF, civilian agents, saboteurs, materiel, or information capabilities for direct action globally. In almost all cases, it will be to the enemy's advantage to act without warning to limit the time available for the U.S. to preempt. After taking the initiative, the enemy will continue to shape the environment through measures aimed at preserving critical capabilities, extending the duration of the campaign, and shattering the U.S.-led coalition.

Once the conflict is joined, the U.S. will conduct shaping operations to achieve dominance across all domains. Controlling the air and sea will grant much greater freedom of action to the entire deployed force. Ground forces will shape the battlespace early through operational preemption to deny the enemy options and seize key terrain. Simultaneously, the JEF will employ knowledge-enhanced psychological operations (PSYOPS) to condition the enemy to fail. Joint SOF will support the shaping strategy with human intelligence and direct action against critical targets.

Restoring maneuver to the battlefield will also be a critical aspect of shaping operations. A concerted effort will be required to degrade the enemy's precision strike system. Joint air, long-range fires, and information warfare (IW) assets will focus solidly on enemy C^4ISR, air defense,

and long-range strike, exposing him subsequently to more thorough-going, piecemeal destruction by agile ground forces exploiting the shock of joint precision fires.

CONDUCT DECISIVE OPERATIONS

In some future contingencies, decision may be achieved quickly using contingency forces. In others, contingency forces will shape the battlespace and set the conditions for the introduction of campaign forces to achieve decision over a longer term. AAN research confirms a number of fundamental (enduring) insights regarding the conduct of decisive operations.

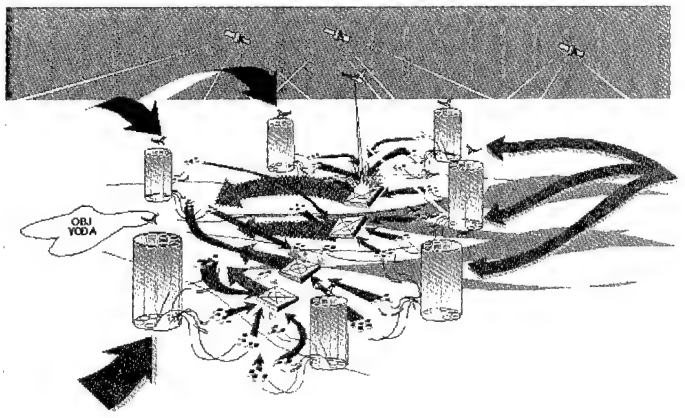
- A balance of operational responses is needed to achieve decision. AAN operations should defy predictability and eliminate the possibilities of single points of failure.
- The mix of forces and capabilities present within the hybrid force must be accommodated and blended through fully integrated operational concepts. Limitations of one element within the force must be compensated by capabilities within another. Balance is essential.
- Because the conditions of the future battlespace will change rapidly, AAN operational styles must be innovative, flexible, and adaptive. The variety of capabilities resident within the hybrid force present a comparable variety of options to adapt to new conditions.
- AAN offensive operations will be sharply focused on enemy centers of gravity, which in the past have not always been easy to identify nor to strike once identified. In 2025, superior capabilities for knowledge, speed, and interdependence will erase much of this difficulty and make it possible to strike centers of gravity even during the opening rounds of a conflict.
- The essence of operational art will endure into the 2025 time frame. In addition to centers of gravity, key principles such as depth, tempo, initiative, and shock will retain high value.

Battle Force Operations

Potentially, the Battle Force will be the most versatile contingency force available to the JEF commander. Its rapid deployment capability makes it suitable for strategic preclusion; once the conflict is joined, Battle Forces will provide unparalleled flexibility with rapid near-vertical maneuver and lethal strike. During sustained operations, Battle Forces will operate with campaign forces in a complementary framework where each element is directed against objectives for which it is optimized.

As currently envisioned, the Battle Force is optimized for two primary purposes. First, its speed and precision capabilities will enable it to conduct devastating offensive operations against large maneuvering formations. AAN wargame results indicate that the presence of Battle Forces in theater may induce an adversary to "freeze" its maneuver forces in place in order to preserve them. Second, not everything on the battlefield has equal value. Knowledge enables the commander to determine what is most important, i.e., center-of-gravity capabilities. The Battle Force will be well suited for direct attack against such capabilities at operational depths.

Within this framework, the Battle Force will adopt a high-precision, force-on-force orientation. Exploiting superior knowledge and decentralized command and control (C^2), the



Battle Force will spread its elements over a large area to destroy or neutralize specific target sets within the objective area. Using its own organic NLOS systems (including manned and unmanned platforms) and reinforced with reach-out precision fires from joint resources, the Battle Force will deliver a huge volume of focused fires within a short period of time, completing engagements within hours versus days. Information dominance and Battle Force agility, conforming to a move-strike-move battle rhythm, will further enable the force to conduct simultaneous engagements throughout the area of operations, resulting in a very high tempo of operations. When surprise is achieved, Battle Force operations will resemble an ambush dynamic.

Shock, surprise, simultaneity, and high tempo can produce a rapid succession of tactical successes against key enemy capabilities, leading to operational disintegration. Although this operational style encompasses substantial destruction of enemy forces, its ultimate measure of merit is the degree to which dislocation and disintegration are achieved.

Urban Operations

In response to the threat of U.S. Battle Forces, the enemy may simply eschew maneuver and go to ground, an approach consistently taken by adversary players in AAN wargames for both operational and political ends. Urban-based defenses severely challenge Battle Force advantages in speed and mobility, forcing it into an environment where dismounted maneuver and direct fires have more relevance. In addition, enemy forces located in cities diminish the effect of a U.S. information advantage because forces are more difficult to locate, target, and assess. Other important insights emerging from AAN research in this area include:

- First, urban operations could become as frequent and routine in the twenty-first century as operations in open terrain have been in the twentieth.
- Second, given the apparent propensity for adversaries to dive into cities when AAN forces take the field, it is unlikely that AAN forces will avoid urban warfare in the future.
- Third, campaign forces and light forces, with their higher dismount strengths, reinforced with urban-specific technologies, appear to offer the most appropriate set of capabilities for urban operations.
- Fourth, urban operations will require a much higher degree of integration with local societies than has been the U.S. experience heretofore.

Already difficult in 1998, the urban problem will become more difficult by 2025. Investigations into possible technological solutions provide no easy answers, thus far. At the macro level, AAN wargaming suggests several broad methods of dealing with this central challenge, each dependent on the specific operational and political conditions of the battlefield:

- First, U.S. forces could exploit superior mobility to preempt or deny enemy occupation of population centers: We get there first.
- Second, if neither the enemy force nor the city itself is of any particular value, it can be bypassed.
- Third, the U.S. could choose to contain, but not destroy, the enemy within the city.
- Fourth, the reduction by stand-off strike operations, although the inevitable collateral damage may be unacceptable.
- Finally, U.S./allied forces could seize the city, a decision that may have a high cost in time, property, and lives.

Clearly, urban operations are an area that will benefit from imagination and creativity that moves beyond narrow technological solutions. An entirely new paradigm for urban warfare needs to be explored to supersede the historical, manpower-intensive, time-consuming operational framework that currently exists.

SUSTAIN THE FORCE

In general, the operational construct described above for AAN forces poses tremendous challenges to the logistics community. Advanced AAN concepts such as highly decentralized operations, extremely high tempo, and operational reach will be dependent

on similarly radical advances in sustainment capabilities. In fact, it appears that the revolutionary capabilities projected for the AAN will not be achieved unless and until there is a corresponding revolution in military logistics (RML). Moreover, the single most important improvement necessary to achieve this RML is neither knowledge nor speed, but a radical reduction in sustainment requirements.

The supporting insights for the statements above can be grouped into four main issue areas. *force closure* and *lightening the force* were discussed previously in the "Project the Force" section. The other two categories are discussed below.

Reducing Requirements

Power and energy requirements pose core limitations on operational and support decisions (given current and emerging technologies). Campaign forces in 2025 will consume enormous amounts of fuel and require a comprehensive distribution system and logistical force structure. AAN-modernized forces will only compound the problem owing to their high battle tempo, range of operations, and the heavy fuel demands of near-vertical maneuver. An absolute imperative exists to develop alternative fuels (nonfossil) or power sources for AAN-era forces. Solar and nuclear power applications appear to be the best near-term alternatives, combined with hybrid applications of existing power sources to achieve more efficient fuel utilization. Continuing advances in precision munitions (one round/one hit/one kill) are also needed to reduce ammunition requirements.

Ultrareliability

Like power and energy, maintenance is a major driver of sustainment requirements. Under current reliability standards, the widely distributed, high-tempo operations anticipated for AAN forces would probably leave a trail of broken combat systems strewn throughout the battlespace. Three core requirements must be met to achieve the ultrareliability needed to keep AAN forces in the field:

- First, ultrareliability must be incorporated holistically into systems, their component parts, and their integrated assembly.
- Second, capabilities for anticipatory maintenance—self-diagnostics, programmable sensors, failure warning, etc.—are required.

Third, AAN crews must have the know-how and on-board spares needed to repair most equipment failures using embedded technical instructions and modular replacements. This approach, of course, will make new demands on crews already well-stretched to meet the demands of their high-tempo environment.

Other-Than-Military (OTM) Logistics Support

Current trends project an increasing reliance by future U.S. ground forces on OTM logistics support including host-nation and civilian sources. Although the use of such sources to shift the sustainment burden has considerable merit, AAN research suggests that such reliance could involve excessive risk. At question is the resilience of such forms of support under the political and operational rigors of a twenty first century conflict. If these challenges can be overcome, however, reliance on OTM support can reduce requirements for the use of organic transportation assets and supply/delivery infrastructure to sustain AAN forces.

Improvements in Combat Service Support (CSS) C^2 and Core Sustainment Functions

The same advanced information technologies that create unprecedented operational battlespace awareness for the Army of 2025 will produce a similar quality of logistics situational awareness. These systems will provide logisticians and operators real-time status of system and unit postures, ranging from in-transit visibility of supplies to status of weapons systems. Combining logistics situational awareness with advanced delivery systems will also expedite and streamline logistical flows. New communications systems will permit full integration of CSS within operational networks, allowing sustainers to communicate across all support levels, including commercial linkages. By virtue of the common

logistics picture, CSS C^2 improvements will reduce the in-theater logistical footprint and enhance split-based operations. These C^2 advances, if coupled with the aforementioned reductions in sustainment requirements, will significantly enhance the integration of logistics and operations planning and reduce the time required for sustainment operations, ultimately leading to a level of seamlessness that blends sustainment and combat operations into a single battle rhythm.

CONDUCT INTERAGENCY AND MULTINATIONAL INTEGRATION

One of the most consistent, recurring themes in AAN investigation of future warfare is the need for more effective integration of U.S. military forces in interagency and multinational operations. Consensus exists that the interagency and multinational content of future operations will continue to grow. In view of this rising significance, this area was added as a seventh pattern of operation. Because land power is the natural integrator of both kinds of operations, the Army of 2025 will likely bear greatest responsibility, within an overall joint context, for achieving effective integration.

Interagency Operations

Integration of interagency operations will not occur smoothly in future conflict unless substantial efforts are taken to create a culture and infrastructure for integration in peacetime. Many serious obstacles must be overcome. The diversity of the interagency, with each agency having its own culture, hierarchy, bias, misperceptions, and unique perspectives, makes unity of effort difficult. The absence of common view, common doctrine, and common terminology regarding how joint forces and agencies should work together is a major hindrance. An entire network of effort is required in the future to achieve interoperability with respect to planning, organization, communications, standards, procedures, materiel, etc. An adequate physical and virtual infrastructure for interagency planning, training, and readiness activities should be established.

Achieving this level of integration will require a long-term, collaborative commitment by the U.S. military and the collective membership of the interagency. For the Army of 2025, these substantial efforts will constitute new demands in terms of time, training, and education that will be difficult to balance with other equally important demands. On the other hand, absent such preparations in peacetime, joint/Army integration with the interagency in conflict will struggle through an inevitable, dangerous period of trial and error.

Multinational Operations

Effective integration of AAN-era forces in multinational operations will suffer from the same obstacles that impede interagency integration—only they will be worse. Interagency operations, at least, enjoy a common language and a common ultimate authority, the NCA, to compel integration, both of which are lacking in the multinational environment. Accordingly, there are relatively low upper limits on the degree to which effective integration can be prepared in peacetime outside of a stable alliance such as NATO.

Forging partnerships to achieve effective cooperation and "interoperability of the mind" in preparation for combined operations will take a long time—and willing partners. Limits on time, resources, and cooperation may prohibit effective partnerships with more than a small number of states. Consequently, it is reasonable to expect that future combined operations will include allies with whom U.S. joint forces have relatively superficial operational ties. Instead of partnerships, AAN forces will need other means of integrating their operations quickly with "new friends". One promising approach, with substantial historical precedent and support from AAN research in regional engagement, is the use of specially qualified, ARSOF-based liaison teams, equipped to provide C^4ISR linkages, cultural compatibility, and common operational perspective.

Finally, the uneven development of military capabilities likely to occur over the next 25 years poses serious impediments to interoperability. Few, if any, future partners will match

capabilities and link smoothly with AAN-era forces. Some will lag far behind. These disparities may mean that coalition forces establish operational linkages most often with AAN campaign forces, vice the more advanced elements.

In summary, the effective integration of AAN forces in interagency and multinational operations appears to be essential for the future battlefield, but one hindered by major challenges. The AAN Project will continue to explore means of responding to those challenges.

KEY TECHNOLOGY ENABLERS

Over the past year, the AAN Project has continued to work hand-in-glove with the science and technology communities to discover how technological advances might affect the way we fight wars in the future. That investigation included both evolutionary developments and revolutionary breakthroughs reasonably possible during the 2010-2025 time frame.

AAN research moved well beyond familiar, near-term technologies that appear safe, but stopped short of entering the realm of science fiction. Investigations thus far have identified a broad array of emerging and potential technologies that could enable revolutionary changes to future warfare. Insights are reported below within the framework of the Patterns of Operations.

PROJECT THE FORCE

Advanced Air and Sea Lift

The bulk of the Army of 2025 will require joint and commercial assets in the form of sea and airlift capabilities to deploy to theater. High-speed ships operating at speeds above 40 knots, with payloads in excess of 2000 tons, delivering cargo over the shore or through unimproved ports, could be possible in the early twenty first century. Similarly, lifting bodies (airships) operating at 150 knots, with payloads in excess of 500, tons and a 4000 nm range, may also be feasible. Commercial fleets, both air and sea, should be built with military specifications imbedded, if we seriously intend to secure dual usage from these vital assets. Such advanced sea and airlift capabilities warrant priority attention; they are essential to concepts of strategic preclusion.

Maneuver Platforms

To support the concept of strategic maneuver, the Army of 2025 will need vehicles/systems designed for easy air and sea lift, including commercial lift capabilities. These vehicles/systems will consist of small, unmanned lethal platforms as well as manned, ground vehicles and aerial assault and lift systems. Modular designs will facilitate air and sea lift, permit mixing and matching to a single chassis, and prove adaptive to new storage and propulsion capabilities. All systems must enable a rapid, efficient intermodal hand-off as the AAN force moves first from CONUS to theater, and then to the tactical battle.

Lightening the Force

Reducing the size of units and the weight and cube of military equipment will expedite force projection. In addition, reductions in logistical requirements, particularly fuel and ammunition, with corresponding reductions in support processes and structures, will further relieve the burden on strategic lift. (Some specific examples of these potential advances are cited further below.)

PROTECT THE FORCE

System Protection

System protection will require layered defenses. Technological advances in lightweight materials, such as composites, ceramics, titanium, or a metal matrix material, will give AAN vehicles a considerable amount of protection at a lower weight. However, AAN-era vehicles cannot depend on traditional armor technologies alone. Instead, they will have to rely more heavily on signature management, countermeasures, possible active protection, and revolutionary mobility. Ground- and air-robotic platforms will also be integral to the survivability of AAN-manned systems and will enhance continuous operations. They will function as bird dogs to ferret out enemy elements for AAN shooters to kill at extended ranges, thereby avoiding unnecessary exposure of soldiers to enemy line–of-sight (LOS) weapons.

Cruise and Ballistic Missile Defense

As noted earlier, the proliferation of cheap, accurate, long-range cruise and ballistic missile systems poses a clear threat to U.S. forces and coalition partners within and outside future theaters of operations. Successful execution of AAN operational concepts is highly dependent on the development of layered, redundant, rapidly deployable, and survivable missile defense systems (ground-, air-, and space-based), capable of defeating a broad spectrum of missile variants and their support structures.

Space Defense

The increasing reliance of U.S. military forces on space-based assets will demand that critical systems be protected by radiation hardening, kinetic kill avoidance, laser protection, deception, and other passive and active protective measures. Such enhancements to DOD systems will also need to be extended in some fashion to selected commercial space objects. Offensive space capabilities developed to disrupt, deny, degrade, or destroy enemy space-based assets, e.g., imaging, antisatellite, or ground attack satellites, will also contribute to force protection.

GAIN INFORMATION DOMINANCE

Situational Awareness

AAN expects to inherit much of its knowledge capabilities from Army XXI and Joint Vision 2010 initiatives. Development of a joint-based knowledge architecture and holistic sensor suite is a DOD challenge to which the Army must actively contribute. This architecture will integrate data from a pervasive network of sensors into a common picture transmitted vertically and horizontally from national to tactical levels. This assured C^4ISR system of systems will require—

- Multiple-route capability to overcome natural or hostile link failures.
- Multimission tasking systems.
- Cheap, reliable, air-, space-, sea-, and ground-based sensors with sense-discriminate-analyze-report functions. Some components of this advanced suite of sensors should be multifunctional and remotely reprogrammable.
- Semiautomated systems capable of acting upon remote-sensor reports as well as operator inputs.
- Neural-net processors.
- Full suite of multicapable UAV platforms, operating at a variety of altitudes and ranges, with self-defense, evasive, and high-loiter capabilities.

Information Processing

Advanced technologies for information processing will be required in 2025 to achieve fusion and to convert the vast quantities of information flooding in from multiple sources to knowledge. Required technologies will include configurable automated filters, automated decision support aids, continuous updating, self-checks, automated comparative analysis, and multiple reporting formats.

AAN will initiate a C^4I integrated idea team (IIT) during the FY99 study cycle to obtain further insights into this vital area of investigation.

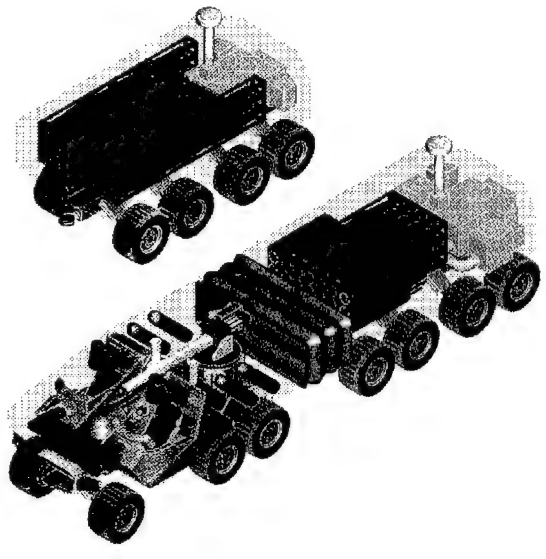
Shape the environment

By and large, the advanced technologies needed to support this pattern of operation are the same as those described in the next section on *Decisive Operations*. However, there are a few specific technological requirements unique to this pattern that can be grouped under the heading of *Collaborative Readiness and Planning*. Given the importance of peacetime engagement to shaping the environment, U.S. forces will require advanced training technologies to improve combined training during peacetime, including advanced distributed simulations. In addition, secure information technologies will be needed to support virtual collaborative planning and coordinated operations with coalition partners. Those technologies may include configurable filters, automated language translation, and tailored linkages for sharing C^4ISR, fires, and target acquisition.

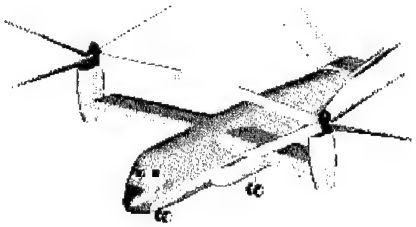
CONDUCT DECISIVE OPERATIONS

Ground Mobility

Achieving the advances in range, speed, increased payload, and duration of operations required for AAN maneuver is not possible without breakthroughs in propulsion and energy capabilities.



Hybrid propulsion systems, fuel cells, battery improvements, capacitors, pulse-forming networks, and other related technology arguably are the most important collective investment the Army could make to enhance the mobility of the future force. The greater speed that can be attained in wheeled, versus tracked, vehicles is another important consideration. Vehicles with more than four wheels, and/or vehicles with each wheel independently powered, offer potential for AAN's weight class of early entry vehicles. Likewise, the Army should thoroughly investigate the potential for surface-effects vehicles such as a hybrid air-cushioned vehicle. On flat terrain or water, the vehicle would employ hover capabilities and on rough and inclined terrain would employ normal wheeled mobility. Physical devices (i.e. exoskeletons, jet packs) to enhance individual soldier mobility also should be explored.



Air Mobility-Airframes

AAN has focused mainly on VTOL and rotary wing to provide airlift and attack options for the Battle Force. A high-speed, folding tilt-rotor attack aircraft, SSTOL, and STOL capabilities were investigated. Propulsion technologies with the potential for efficient, lightweight, and affordable operation include turbo-shaft engines and high-torque drive systems. It appears that lightweight, affordable rotorcraft structures might be achievable through innovative structural concepts, high strength/stiffness-to-weight materials, and integrated design/manufacturing processes. Promising aeromechanical technologies include high-light, efficient, low-vibration rotors; active rotor flight control systems; aerodynamically efficient airframe and engine installation concepts; and lightweight, low-drag, rotorcraft folding concepts. The next AAN Mobility IIT will examine a range of current and new airframe options, as well as continue its investigation into ground mobility technologies.

Fires

Precision fire support, largely in the form of reach-out fires, will prove vital to facilitating AAN maneuver. Strategic suppression fires supporting JEF strategic maneuver may be launched from any domain, employing laser systems, intercontinental cruise or ballistic missiles (carrying submunitions or special purpose warheads), or even continental artillery–employing a blast-wave accelerator cannon to send 1000 pound projectiles anywhere in the world. Once in theater, the JEF will exploit advanced, extended-range NLOS and LOS ground systems, Navy and Air Force air capabilities, to include high-powered, microwave warheads (HPM), and continued fire support from the aforementioned strategic suppressive systems.

Target Acquisition

Much of this very critical function will be accomplished via space-based sensors providing highly reliable, real-time target recognition and selection capabilities. Increased investment is needed in the near term in the areas of sensor fidelity, sensor fusion, and automatic target recognition. Precision systems in AAN may include munitions that lock on after launch and fly autonomously to a target area, identify a target (possibly with a man in the loop), and engage with terminal homing. In a fast-paced, complex battlefield where forces disperse to overwhelm enemy systems and units, future precision-strike systems will require improved image recognition to differentiate between friendly and enemy targets. UAV and unmanned ground vehicle (UGV) will also play a vital role in target acquisition and mitigate the risk to manned platforms by reducing exposure to enemy detection. In-flight updates via global positioning system (GPS) satellites will enhance precision or focused maneuver.

Advanced Munitions

The traditional line between gun and missile and LOS and NLOS, will become blurred as engagement ranges increase and munitions designs exploit sensors, computing power, and maneuverability. Programmable munitions may become the norm, and stealth will become an increasingly significant weapon/munition design consideration to prevent jamming, spoofing, and deception.

Nonlethal Weapons

The ability to couple nonlethal effects with precision delivery will provide future military commanders with an improved range of options for precise control of target effects. The implications presented by the variety of technologies expected to be available in the future and their applicability to a broad spectrum of battlefield conditions are simply staggering. For example, large-area effect nonlethal munitions should present capabilities for effective suppression at a much reduced logistical cost compared to lethal munitions. Substantial effort is still required to identify the most promising technologies and to discover the best means for integrating lethal and nonlethal capabilities.

Missile Standoff

Continued research into advanced missile concepts is critical. The importance of out-ranging threat-precision munitions is not likely to diminish despite technological advances in missile defense and mobility advantages. The AAN Project will examine ranges beyond 60km. Over-the-horizon, NLOS direct fires might also be possible in the AAN time frame.

Mobility Operations in Urban Terrain (MOUT)

Meeting the challenge of fighting in urban environments will also require advanced technologies. Employment of small UAVs, UGVs, and other robotics will enhance information dominance and survivability. Structure-penetrating and mobile sensors will be needed to see through, under, and around urban structures. Small-yield, maneuverable precision munitions will provide focused effects and reduce collateral damage. Urban-tailored communications networks and highly-maneuverable air and ground assault vehicles will be required to deal with urban clutter and restricted pathways. Finally, nonlethal munitions

offer significant promise as a means to create wide-area effects while avoiding civilian deaths and collateral damage.

Sustain the force

Reducing Sustainment Requirements. The revolutionary logistical improvements needed to support AAN operational concepts are among the most daunting facing the future force. The single most important area for improvement is the need to achieve radical reduction in sustainment requirements. Progress demands:

- Breakthroughs in alternative power sources and fuels, including hybrid, solar, and nuclear power applications.
- Major improvement in fuel efficiency for fossil fuel engines.
- Continued advances in precision munitions toward a one-round/one-kill standard.
- Progress in ultrareliability: prognostics, diagnostics, modularity, embedded repair, etc.
- Development of new materials to achieve reductions in volume and weight of equipment and materiel.

Logistical Situational Awareness

The advanced information technologies described earlier as the means for achieving information dominance will also lead to a high level of logistical situational awareness and will vastly improve logistics C^2. These enhancements will also contribute to the reduction of requirements by streamlining supply flows. The ultimate result will be highly integrated logistical and operational planning, blending sustainment and combat operations into a seamless battle rhythm.

Most of the technologies described in this section are already under development. They, and many others, will appear in one form or another on tomorrow's battlefields. When they do, they will enable or wholly comprise revolutionary capabilities.

The AAN project will continue to investigate these technological enablers, and explore their effect on application of land power in the future with a view toward informing future combat developments.

IMPLICATIONS FOR THE ARMY'S IMPERATIVES

Undeniably, the future operational environment described in the preceding sections of this annual report portends radical changes for the Army of the future. AAN-era soldiers and leaders will be challenged with executing operational concepts of unprecedented scope, complexity, and sophistication, demanding a level of elevated individual and collective performance that exceeds the Army's best efforts in 1998. Technological advances will significantly alter the way the future Army organizes, trains, moves, fights, sustains, and executes its missions across the spectrum of conflict. Requirements for change will be continuous and profound.

The Army has deliberately developed an institutional culture that is receptive to change and a broad framework for managing change—the Army Imperatives. As change is integrated holistically throughout the Army, the six imperatives mandate that balance must be maintained across each of the six areas.

Army Imperatives

Quality People
Leader Development
Training
Force Mix
Modern Equipment
Doctrine

The imperatives comprise a prism through which the Army's posture can be viewed today, tomorrow, or at any point in its history. As such, they provide a useful framework for presenting AAN-derived implications regarding how the Army will likely have to change to meet the challenges of 2025, with one caveat. Given the long-range perspective of the AAN Project, the observations below should be viewed as descriptive, rather than as a prescriptive recipe for change.

QUALITY PEOPLE

One of the most compelling insights from AAN research is the observation that the soldiers who man the Army of 2025 will have to be more capable than at any other time in America's history. The average high school graduate that has been "good enough" for the Army of the last half of the twentieth century may not be good enough for the Army of 2025, particularly for manning the most modernized elements of the hybrid force. Certainly, future soldiers will have to have a fundamental level of proficiency with information technology upon initial entry. Many soldiers and junior leaders will be required to accept more responsibility earlier and to execute that responsibility with initiative and superior judgment. Battle Force effectiveness may require special selection and rotation policies that retain personnel strictly within that arm of the force. The implications of these developments for recruitment, retention, and pay scales may be substantial.

Personnel Stability

The need for cohesion and continuity within AAN organizations will require longer assignments to specific units. The level of turbulence that has typically characterized Army personnel operations probably cannot be tolerated in 2025.

Values

As leaders and soldiers become more technologically sophisticated, the Army will have to ensure that its values—the Army's intangible link to American society—remain relevant.

Nonmilitary Personnel

The growing complexity of military equipment and out-sourcing of selected missions will cause a growing level of reliance upon contractor support in theater, with concomitant requirements to extend support and protection to them.

LEADER DEVELOPMENT

The demands of future conflict will continue to place great responsibility on leaders at all levels, requiring mature judgment even while they are still gaining experience. The future battlespace will also demand leaders who can operate in an environment of uncertainty with courage, initiative, and resolve. Requirements for proficiency will increase in a number of areas. In short, tomorrow's leaders will have to accept change readily and be adaptive to and proficient in the use of a wide range of new technologies, particularly information technologies.

Joint Qualifications

Army leaders will need joint education and experience earlier in their careers. Army schools will need to introduce/expand joint education at the company-grade level. The scope of joint education must also be broadened to encompass more officers from all Services and to include the entire range of military operations. Although competing requirements will be difficult to reconcile, a balance must be found between Service professional military education (PME) and joint PME.

Interagency/Multinational Operations

Similarly, Army officers will need more formal training, education, and exposure to interagency and multinational operations. The Army must establish deliberate goals and programs to expand leader proficiency within these two areas.

Specialization

The growing sophistication of operations, the multiplication of new skills, and the rising technical complexity of many functions will probably drive the Army toward greater specialization, particularly within the officer corps. At the same time, the Army will also need generalists, particularly as combat and support integrators. Reconciling these competing requirements will demand greater precision in officer training, education, and assignment patterns and greater efficiency in personnel management.

Overall, considerably more time will be required to fully prepare Army leaders to execute their responsibilities for the environment of 2025. Technological innovation will be needed to extend the reach of PME outside the classroom into the field. The Army will need to develop a culture of continuous education that both demands and rewards leaders for staying abreast of change.

Training

Training requirements for AAN-era forces will be greater than the already heavy burden that exists today. Simply put, the contingency-focused Army of 2025 will have more missions, environments, threats, and partners for which it must prepare.

Training management must improve in order to optimize the time spent participating in training, vice preparing for training. Moreover, forces committed to ongoing stability and peacetime engagement operations will need some means to maintain training readiness while engaged in these missions. Multiple contingencies and short-notice deployments may require just-in-time, on-call, and en-route training and rehearsal capabilities to prepare forces for immediate commitments. Information technologies and advanced training processes must be exploited to permit the integration of individual and collective training during routine operations and other training-hostile environments.

RC Training Readiness

Greater integration of RC into the Army and joint training systems will be required to improve total force readiness. RC training will have to be capable of surging to meet the wide range of challenges of the new era. Training means must be focused on capabilities and procedures to bring RC forces quickly to a high level of training readiness.

Joint and Interagency Training

For interdependence to develop, the Army and joint training systems must grow more closely together. Electronically linked training centers offer one means to enhance the quality

and scope of joint training and to strengthen the basis for training-based experimentation. A long-term collaborative effort will be required to establish the common doctrine, process, and infrastructure (physical and virtual) needed for effective interagency training. Such an effort may require the development of a National Interagency Training and Readiness Center over the next decade or so.

Simulation-Based Training

Advanced simulations will offer tremendous potential to solve or mitigate some training challenges. However, future simulations must:

- Provide realism
- Expand to cover all operating environments
- Incorporate joint, interagency, and multinational capabilities
- Be globally distributable
- Adapt quickly to doctrinal and technological change
- Span multiple levels of training audiences.

Considering the great difficulty of conducting live MOUT training on the scale anticipated for twenty first century operations, it will be important to develop a virtual Urban Training Center.

Finally, the content of Army and joint training programs must necessarily expand to encompass new mission areas and threats, including MOUT, force protection, WMD defense, information operations, and, for selected organizations, homeland defense.

FORCE MIX (Organizational Characteristics)

Speculation has been ongoing for several years that the Information Revolution and advances in precision weaponry would lead to a proliferation of smaller units and the flattening of the Army organizational hierarchy. Certainly, the projected development of organizations like the Battle Force and Strike Force represents a limited transition to smaller self-contained units and more horizontal hierarchies. However, additional work is required to produce authoritative insights regarding the ultimate evolution of organizational and command hierarchies of the future force. Nevertheless, some core characteristics of future Army organizations are evident at this time.

Modularity will enable discrete building blocks of combat and sustainment power to be combined to meet the specific requirements of any given scenario. However, modularity must rest, when possible, upon habitual relationships in order to build trust, confidence, and cohesion. *A culture of teaming* will complement modularity and enhance ad hoc arrangements in conflict, as well as AC/RC integration for training and operations. *Autonomy* will be a fundamental characteristic for AAN units trained and organized to execute high-tempo, decentralized operations, strengthened by improved capability for self-sustainment. *Cohesion* will ensure that AAN units can fight and win while weakened, stressed, or placed in unusual circumstances. *Adaptability* will permit AAN-era forces to meet the changing conditions of the battlespace, to respond to technological or methodological surprise, and to operate in concert with forces with differing capabilities. The expected pace of technological change will require that all AAN-era forces possess a "growth potential" for technology "injections" during a unit's life cycle.

Considering the expectation that MOUT will be a frequent mission for AAN-era forces, the capability to succeed in complex terrain must become a first-priority force-design parameter for a substantial part of the Army of 2025. The future Army must also include the organizational and materiel features needed for improved interoperability with interagency and multinational formations. Building and

maintaining all the characteristics described above will require continuous organizational experimentation. The Army should keep a permanent experimental force in being for this purpose.

MODERN EQUIPMENT

The technological and materiel requirements projected as essential for the future have been discussed in considerable detail in the previous section (Key Technology Enablers) and in Annex A, "Special Report on Technology." Even if only a portion of these innovations are realized, their cumulative impact on change within the future Army will be profound. Moreover, the requirement to choose between the multiple pathways that will appear feasible during the next 25 years may be among the most difficult challenges to resolve. Comparing evolutionary and revolutionary approaches, and balancing technological and fiscal feasibility with the need to manage the pace of change across the other five imperatives, will demand vision, judgment, and the highest quality of decision-making. The AAN Project's continuing investigation along its technology azimuth will undoubtedly play an important contributing role in this process.

DOCTRINE

One of the most significant challenges of the AAN era will be the need to reconcile the development and inculcation of doctrine with the accelerating pace of change. In the post-WWII era, Army doctrine reinvented itself roughly on an 8-10 year cycle, a cycle which may not be suitable for the future. The doctrinal process must also be tied closely to the rise of new mission areas, such as homeland defense, to insure that doctrinal guidelines emerge quickly enough to prepare Army units to operate effectively. Another major challenge will be the necessity to develop a suite of integrated operational concepts that melds and blends components within the hybrid force, including the RC. The doctrinal community must anticipate requirements and combine experimentation, doctrinal development, and training into one seamless process. Several specific themes deserve special emphasis:

Battle Command

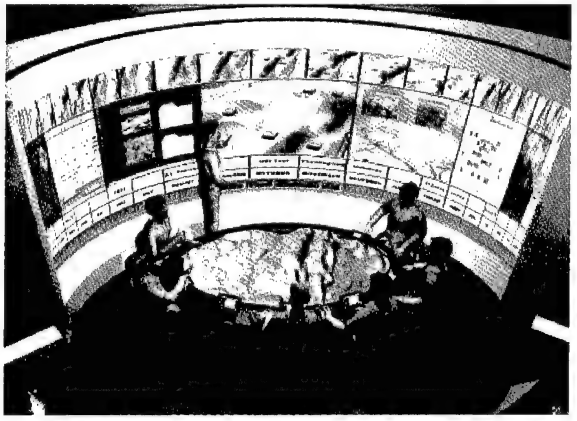
Army digitization has already begun to discover some of the substantial changes to the command process that must accompany advances in information and communication capabilities. New concepts are emerging with regard to dual/shared command and the reorganization of traditional staff functions into current and future operations cells. The development of new capabilities such as automated decision aids, theater-wide updating, and real-time analysis of courses of action will almost certainly change battle staff and command processes further.

Urban Operations

Future doctrine must address MOUT as thoroughly as it does operations in other environments. MOUT doctrine must move beyond its current, largely tactical perspective to a new paradigm that encompasses strategic- and operational-level considerations.

Interdependence

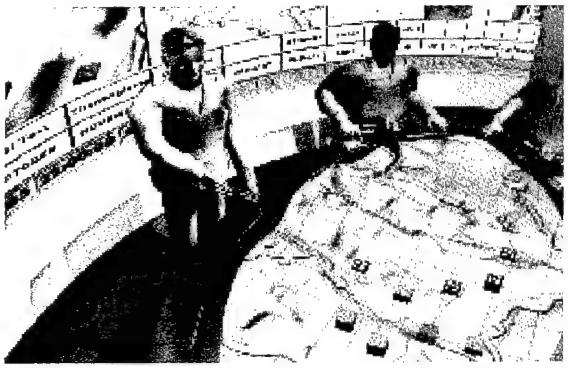
Progress toward interdependence will heighten the need for joint doctrine. Mission migration to joint structures and the expected merging of certain Service-specific functions will likely generate an increasing requirement for interservice tactics, techniques, and procedures. Doctrinal revisions will have to flow rapidly back and forth between the Services. Ultimately, joint requirements may drive time lines and requirements for Army doctrine.



Interagency/Multinational Considerations

Doctrine will also need to reflect much greater integration of Army forces within interagency and multinational contexts, as well as significant interaction in the battlespace with civilian societies, contractors, and nongovernmental organizations. Although virtually every future doctrinal manual will probably need to include new guidelines in these areas, logistics doctrine may be the most affected.

The Road Ahead



Nineteen ninety-eight was an important year for the AAN Project both in terms of the discovery and exploration of some vital issues and for the growth and maturity of the project itself. The mission of "institutionalizing the process" was achieved and has made a significant impact in the process of change for the Army. The rapidly growing body of new discoveries and bold possibilities provides an exciting foundation for the growth of our Army.

From this solid footing we will continue to explore insights from the previous study, to conduct research, and to explore new horizons. Some opportunities are to:

- Further shape the application of 6.1, 6.2, and 6.3 funds to advances in critical technology areas. In FY99, develop more AAN-based 6.1 strategic research objectives (SRO) for consideration. In addition, apply AAN criteria and time lines to all 6.2 science and technology objectives (STO) (new and continuing) to better inform the science and technology community of their long-term utility. Based on the insights gathered to date, we are confident that in FY99 we can migrate the most promising ideas to the combat developments and science and technology communities using the future operational capabilities (FOC) format and review cycle. Not only will this provide a long-range focus for science and technology programs, but the application of criteria and time lines to existing and emerging FOCs will improve their overall utility.
- Open and develop a dialogue with and provide support to the joint community as they enter the arena of future joint force integration and experimentation.
- Expand our progress in creative integration of AC and RC contributions to the future total force.
- Apply the insights gained through AAN to quicken the development of such near-term initiatives as the Strike Force and the future combat vehicle.
- Refine our perspective on the nature of the future strategic environment and ensure consistency between AAN and the Army Strategic Planning Guidance (ASPG).

We are investigating creative methods for better leveraging our resources and integrating our efforts. One promising possibility is to significantly expand AAN franchise activities into new communities, both inside and outside the Army. In FY99 we will add four new AAN franchises to complement study and research efforts.

Additionally, following the Spring Wargame, TRADOC will host six satellite seminars, one for each Army Imperative. The seminars will be followed by an imperatives integration conference designed to examine the interactions and ensure balance across the imperatives. Insights from this process will be incorporated in the 1999 report to the CSA and the process will be embedded into the long range AAN research and study plan (FY00 and FY01).

FY99 AAN GOALS

Based on the growing list of insights and issues discovered thus far and with direction from Army leadership, the AAN Project will focus its FY99 study and research into exploring the following areas:

FY99 Overarching Study and Research Focus

AAN-Era Forces: Develop an operational theory and organizational concepts for the entire hybrid force

STRATEGIC SETTING

Examine the nature of the sociopolitical, economic, military, and informational environments of 2020-2025 and the effects of those environments on major military operations.

FORCE PROJECTION

Examine force projection concepts and capabilities to enable strategic maneuver of AAN-era forces.

FORCE SUSTAINMENT

Examine sustainment considerations and logistical operations concepts and capabilities for AAN-era forces.

HYBRID FORCE EMPLOYMENT

Explore concepts and capabilities of AAN-era hybrid forces for warfighting and for stability and support operations.

URBAN/COMPLEX TERRAIN

Develop and examine concepts for the employment of AAN-era forces in urban and other complex terrain.

AC/RC INTEGRATION

Identify operational concepts and capabilities that promote the seamless integration of future AC and RC forces.

HOMELAND DEFENSE/WMD

Examine the role of the total Army in homeland defense, including protection against use of WMD.

JOINT OPERATIONS/ INTERDEPENDENCE

Examine the essential partnerships that AAN-era forces must create and maintain with U.S. military services and other government agencies.

COALITION OPERATIONS

Examine the challenges and opportunities of the possible partnerships that AAN-era forces will establish with coalition partners and non-government agencies.

SCIENCE AND TECHNOLOGY ENABLERS

Identify technologies that meet stated AAN-era capability requirements and highlight promising technologies with the potential to radically improve the effectiveness of AAN-era forces.

AAN explorations have provided tremendous insight on future strategic environments and the wide range of potential missions the future Army is likely to face. They have shed some light on what approaches appear most promising, what long term preparations and investments must be considered, and how to better articulate future warfighting needs. Next year's study and research promises an even richer body of knowledge regarding AAN-era forces and their role in future conflict.

Annex A
Special Report on Technology

INTRODUCTION

The Army has long recognized that technology enables new warfighting concepts and offers opportunities to develop new capabilities. Fundamental to the AAN effort is the belief that the Army must continue to link evolution and revolution in technology to our vision of the Army of the future. The greatest challenge is dealing with the rapidly accelerating pace of technological change, which will strain our ability to forecast trends, uncover key opportunities, and quickly incorporate new capabilities.

The Army faces other dilemmas in the coming years. Fiscal reality and the growing number of emerging technologies demand that the Army leverage the science and technology work of the other Services, other government agencies, and the marketplace. Our growing reliance on commerce as a major source of new technologies and services will not be lost on potential adversaries. Proliferation in the open market will test the Army's ability to maintain a technological edge. State and nonstate entities may challenge us by fielding capabilities that are asymmetric counters to our own, many derived directly from the marketplace. Finally, adversaries will use the same commercial infrastructure that we rely on for information, communications, and other aspects of combat power. Sound Army science and technology investments will become even more critical in addressing these potential concerns.

To develop insights and innovative concepts, to identify critical enabling technologies, and to decide on a proper investment strategy, we have teamed the Army's science and technology community, combat developments community, and AAN Project. The 30-year point of focus to the 2025 time frame for the AAN Project gives the military art and technology experts time to explore alternate approaches to achieving the AAN vision. It allows time to incorporate innovative technologies as well as unanticipated revolutionary discoveries.

This is not to say that current and programmed Army science and technology investments do not support AAN goals and objectives. On the contrary, these investments are producing innovative technologies and systems. As AAN insights are developed and the AAN vision refined, the science and technology strategy will be adjusted accordingly.

INSIGHTS

AAN study and research efforts over the last year and a half have identified knowledge and speed as the central themes for the Army of 2025. The compression of time at the strategic, operational, and tactical levels is the common physical parameter tying these themes together, presenting a central challenge to technologists working to provide the capabilities the future Army will need.

Advanced information technologies ensure that every member of the warfighting team has a common picture of the situation without delay, enabling rapid planning and execution at all levels. Advanced mobility platforms with greater speeds reduce the time to deploy globally, maneuver operationally and tactically, traverse the killing zone, and engage the enemy, and provide timely logistical support. It also

means that we rapidly integrate joint and coalition capabilities into a singular interdependent force to conduct decisive, full-dimensional warfare. Moreover, this future force must synchronize commerce and contractors seamlessly and without interruption. An essential body of technologies is emerging that offers the potential to create such a force.

Knowledge will proceed from a robust, redundant, and flexible network of communications and intelligence systems connected from surface to space. This network will enable our forces to operate on the move in nonlinear battle spaces and in urban and complex terrain. Even with commercial segments, it will be designed to avoid the pitfalls of an overly integrated, network-centric architecture, degrading gracefully rather than catastrophically when under attack. Distributed elements will support this approach. Surface sensors will be connected electronically to a series of interlinked unmanned reconnaissance, intelligence, surveillance, and target acquisition aerial vehicles (UAV), ranging from low to very high altitudes, as well as space-based systems. These space systems will provide constant surveillance over the battlespace and will connect the combat force with its distant support and sustainment base.

To further reduce vulnerability of this vital communications and intelligence infrastructure, UAVs and space-based systems provide complementary and redundant capabilities. Mechanisms also must be established for both rapid replacement of degraded systems and substitution to minimize system interruptions.

Strategic, operational, and tactical speed must leverage our information capabilities. This begins with rapid projection of substantial combat power. The AAN Project has provided visibility and impetus to technologies for fast sealift and large-capacity airlift needed to accelerate global power projection, energizing the joint community on capabilities that will benefit the entire force. Also being explored are the possibilities of self-deploying forces that could bypass traditional lodgment areas and avoid transmodal delays in order to deploy directly into combat, developments which would provide a significant strategic-force option.

Sustainment in all its dimensions impacts the speed of the force. Shrinking the logistical tail from CONUS to the theater of operations and on the battlefield itself is a fundamental goal to fielding AAN-era fighting forces. Many technologies simultaneously support ease of deployment, enhance operational speed, and reduce logistical demand. A prime example is reducing the size and weight of platforms through a combination of advanced lightweight materials, ultrareliability, fuel efficiency, and precision weaponry.

To achieve the degree of knowledge dominance and operational speed envisioned in the 2025 time frame, the Army must expand its traditional two-dimensional spatial orientation into the vertical or third dimension. Technology assessments inform the operational concept of vertical and near-vertical envelopment by greatly extending the speed, range, and lethality of such forces to operational depths.

Operators and technologists continue to work together to develop a variety of force designs with supporting notional systems with a specific focus on advanced airframes. The goal is to significantly increase inter- and intra-theater airlift and reach, speed, and lethality for attack airframes. Greater reliance on airframes creates new technological challenges—survivability and countermeasures, fuel efficiencies, and ultrareliability.

Complementary to deployment and theater mobility platforms, in the context of integrated air-ground land power forces, are future ground combat systems, which must now have greater firepower, mobility, and speed at significantly reduced weight and sustainment levels. Enabling technologies include advanced lightweight materials; fuel-efficient, hybrid electric-power systems; long-range precision fires; and survivability measures such as active protection and signature management that trade off of traditional ballistic protection.

A promising application of a large set of technologies is the employment of a full range of autonomous and semiautonomous unmanned systems. Robotic systems would have a major

impact on the capability and survivability of soldiers, platforms, and forces. Their use in urban and complex terrain suggests revolutionary advances in capabilities. Robotic, remoted, and augmenting systems would free soldiers, crews, and leaders of any number of tasks, potentially reducing the number of soldiers deployed in the battlespace while increasing the range of capabilities of the force. Robotic companions to manned air and ground platforms would mean a lighter yet more survivable force. Robotic elements of the force would enable such operational concepts as remote warfare, standoff security, and reach-out fires, intelligence, and sustainment.

Our technology investigation into fires recognizes the need to balance precision and area effects, organic and reach-out assets, responsiveness and range, flexibility and survivability, and capability and reduced logistical burden. The operational concepts of strategic maneuver and reach-out fires with platforms that remain outside the battlespace have received special attention. Fires platforms based in CONUS and in space, such as intercontinental blast-wave-accelerator artillery and space-based lasers, would provide immediately responsive fires to precede and support early-entry forces.

Such platforms would be part of a full range of systems provided by every Service and available to create a multitude of effects against personnel, materiel, and information systems. Lethal, nonlethal, and information attack means would be employed to attain these effects. The emerging concept of effects-based fires over systems-based approaches places a substantial burden on the enabling technologies for platforms, sensors, and communications, while relying even more on interdependence.

New approaches to designing fires platforms and munitions depend on advances in technology. Multifunctional systems that engage an array of ground and air targets are key. Increasing the range of artillery and missiles with advanced propellants is another. Loitering systems help improve responsiveness. And remoted unmanned firing platforms add a new dimension to fires on the battlefield.

While the emphasis remains on precision weapons to focus effects, minimize collateral damage, lighten platforms, and reduce the sustainment burden, nonlethal weapons promise the ability to provide much needed area suppression effects against unlocatable targets, dispersed targets, and targets in urban/complex terrain. We must resolve issues of policy, collateral effects, and logistical demand (to include power requirements) as we continue to explore nonlethal weapons.

The soldier continues to be the ultimate building block of all Army organizations. On the battlefield, the soldier as a system provides an even more capable warrior as we seek to exploit human and cognitive engineering, better understand the biological and psychological bases that influence human effectiveness, and provide improved protection, to include biological and chemical vaccines and antidotes. Dismounted soldiers will still be needed for combat in complex terrain, especially in urban and jungle environments. Here the focus must be expanded to small teams as systems.

TRADOC/RDA PARTNERSHIP

During this past year we have demonstrated that the collaborative process between warfighters and technologists works. The more interplay between the communities, the more we are able to uncover the key issues and insights. This is in keeping with the idea that technology should not be addressed in a vacuum, but must be viewed in the proper context.

A truly effective land power force emerges from the innovative nesting of operational concepts, organizational design, deeper understanding of human behavior in combat, projection of the future geostrategic setting, and assessment of where technology is likely to take us in the future. During the last two years, policy and the marketplace had a vital impact on emerging technologies. With the establishment of the AAN Project, the Army has the means to develop a warfighting vision far enough ahead to give the longer-term investment strategy greater specificity. AAN also provides a forum

for technologists to participate in the development of the AAN vision itself, to suggest new applications of technologies, and to view technological trends in a greater context.

The research, development, and acquisition (RDA) community has partnered with the AAN Project to develop the AAN vision. The most innovative efforts have been the IITs. The IIT concept was developed by the U.S. Army Training and Doctrine Command and the Army principals for science and technology, the Office of the Assistant Secretary of the Army for Research, Development, and Acquisition (SARDA), and the Army Materiel Command (AMC). The enabling organization for the IITs is the Army Research Laboratory (ARL).

IITs have proven to be a productive method of effecting the interchange between the warfighter and the technologists. To date, IITs have been established for operational/tactical mobility and for fires. The mobility IIT focused on the air and ground systems required to enable vertical envelopment to operational depths. The fires IIT explored the platforms, munitions, sensors, and C^4I assets required to fully enable AAN capabilities.

Two companion efforts followed the mobility IIT. SARDA sponsored independent feasibility/affordability teams to further assess the notional air and ground systems refined by this IIT. SARDA and TRADOC Analysis Center (TRAC) also sponsored a Rand Arroyo Center study to carry out a higher resolution, force-on-force analysis of the notional systems and supporting technologies devised by the IIT.

AMC and ARL sponsored a fuel efficient AAN white paper and a follow-on study to assess the feasibility of substantially reducing the demand on fossil fuels in the2025 time frame, as well as the RDA investments necessary to make this happen.

ARL supported the AAN Spring Wargame by coordinating technology advisors for the player cells and technology assessors to support game adjudication. ARL also helped conduct the nonlethal technology cell workshop during the game. An area of concern to the CSA, the cell brought together representatives from joint nonlethal offices, the Services, and industry to explore nonlethal technology applications in the 2025 time frame. A substantial tool kit of potential nonlethal systems was developed by this cell. SARDA initiated the first Army Technology Seminar, 27-31 July 1998, at Carlisle Barracks, PA. The purpose was to assess technologies that may benefit the Army both in the Army XXI and AAN eras. An issue of particular interest to SARDA was how to bridge the gap between the two eras.

AAN TECHNOLOGY LONG LIST

STRATEGIC MANEUVER

- High speed ships capable of over-the-shore or unimproved port throughput..
- Ultraheavy airlift.
- Information capabilities to provide en-route planning, analysis, intelligence preparation of the battlespace (IPB), training, and rehearsal.

LIGHTEN THE FORCE

- Breakthroughs in materials to reduce weight.
- Lighter, cheaper, more effective precision munitions.
- Ultrareliable mechanical components and systems.
- Lighter, nonpetroleum-based, alternative power sources.
- Protection
- High confidence defeat mechanisms for cruise and missile defense.
- Active protection systems for lightweight ground platforms.
- Space-defense technologies: radiation hardening; kinetic kill avoidance; location deception.
- Space-based WMD sensors.
- Low-signature technologies.

- Advanced protective materials for construction of combat vehicles.
- DOD enhancements to selected commercial space objects.

INFORMATION DOMINANCE

- Assured C^4ISR system of systems.
- Information processing technologies: configurable automated filters; automated decision support aids; real-time, continuous updates and feeds; self-checks; automated comparative analysis; multiple reporting formats.
- Cheap, reliable, air-, space-, and ground-based sensors with sense-discriminate-analyze-report functions.
- Full suite of multicapable UAV platforms, with self-defense or evasive capabilities.
- Anti-UAV capabilities.
- Technologies to achieve temporary disruption of space-imaging systems covering a given terrestrial theater.
- Secure information technologies supporting virtual collaborative planning with coalition partners.
- Tunable digital transmitters.
- Advanced sensors, e.g., laser radar (LADAR).
- Microelectricmechanical systems (MEMS).
- Nanotechnology.

DECISIVE OPERATIONS

- Fuel-efficient, ultrareliable airlifters
- Unmanned, remotely-operated long-range precision fire and air defense systems.
- Light armored ground combat platforms.
- Advanced fire support systems.
- Mobile NLOS communications.
- Multipurpose, extended range munitions.
- Assured BDA.
- High-speed, all terrain mobility.
- Distributed, fully integrated fire control of joint fires.
- Active protection systems.
- Large area effects nonlethal weapons.
- Robotics.
- UAVs.
- Stealth for ground and air systems.
- Advanced gun propulsion.
- Advanced rotorcraft.
- Advanced aircraft engines.

SUSTAINMENT

- Information technologies to support logistical situational awareness.
- Integrated communications and collaborative planning capabilities.
- Alternative power sources and fuels.
- Major improvement in fuel efficiency for fossil fuel engines.
- Ultrareliability: prognostics, diagnostics, embedded technical maintenance instructions; modular components; failure warning.
- Lighter armor and lighter automotive materials.
- Lighter, more precise munitions.
- Turbochargers.
- Portable desalinization.
- Advanced water production.
- Hybrid electric-drive systems.

THE WAY AHEAD

The AAN Project focus on technology continues with a growing number of partners in the science and technology and combat developments communities. We began with a period of broad discovery to uncover possibilities offered by future technology, but we are now placing more emphasis on specific research questions to refine early findings, explore new areas, and conduct trades on enabling technologies. The result will be a greater level of detail in AAN insights driven by capability requirements.

To properly assess the potential impact of technology on future capabilities, we will undertake more rigorous modeling and simulations studies and begin to focus on budget constraints and a realistic strategy to mix legacy

and AAN systems. This approach will become our experimental base for technology until the combat developments process identifies appropriate science and technology objectives (STOs) and advanced technology concept demonstrations (ATCD) that explore AAN issues.

As the AAN process continues to mature, AAN will become part of a growing number of science and technology decision-making teams determining future investments in basic and applied research. The greatest impact AAN has had on investment so far is in supporting the development of new Army SROs to set a direction for basic research and identifying critical STOs that focus applied research to address AAN requirements.

Today, global institutions and cultures are busily shifting from the Industrial to the Information Age. The Army today has a foot firmly planted in both ages. Systems and structures developed in the era of the recent past must now either be modified or replaced to prepare for conflict in the Information Age. Central to this decision is whether current and programmed systems will satisfy the requirements of a 2025 battlefield. AAN study and research suggests that tomorrow's battlefield will differ from today's in revolutionary ways. The Army's leadership must soon determine how to apportion research and development resources among a host of competing technological alternatives. It must also determine how much of the Army to modernize along current lines before transitioning from Army XXI systems to new technologies and systems with significantly different operational and organizational concepts. Innovative partnerships with industry offer the means to leverage emerging technologies and services at reasonable costs. Industry partnerships could mean the development and support of new systems from cradle to grave. These are challenges that demand effective, focused science and technology efforts to get to AAN.

Annex B
AAN Franchise Reports

To accomplish its mission to "Conduct broad studies of warfare to about the year 2025 to frame issues vital to the development of the US Army" and to rigorously explore all areas necessary for a comprehensive study of the future, the AAN Project expanded its efforts in 1998 by franchising specific critical study and research areas. The franchise arrangement provides the necessary structure and expertise to investigate in detail particular critical areas; it has proven to be extremely beneficial to the AAN project overall.

Franchise explorations discovered a wide range of issues and insights. They enlarged their own particular body of knowledge and made critical contributions to the AAN Project at large. The continuous dialogue and exchange of discoveries have developed a synergy within the overall AAN process.

Although AAN franchises have latitude to explore within their own areas of interests, they use the AAN "History of the Future" and other game materials as basic references. Additionally, franchise events are integrated into the comprehensive AAN study and research effort by the annual Study and Research Plan (SRP), and their objectives are designed to support those AAN Projects. As with the AAN Project itself, franchise sponsors provide an annual report that summarizes their annual study and research, offers issues and insights, and presents a road ahead for the coming year.

During this annual study and research cycle, the AAN Project profited from the contributions of four franchises:

- CSS sponsored by the U. S. Army Combined Arms Support Command, Fort Lee, Virginia.
- IO, sponsored by the DCSINT, U.S. Army Training and Doctrine Command, Fort Monroe, Virginia.
- SOF, sponsored by the U.S. Army John F. Kennedy Special Warfare Center and School, Fort Bragg, North Carolina.
- Space, sponsored by the U.S. Army Space and Missile Defense Command, Arlington, Virginia.

Specific insights and issues from their study and research were incorporated in the *Discoveries: FY98 Study and Research* section of this report to the CSA. Their detailed annual reports follow.

FRANCHISE REPORTS

Appendix 1
FY 98 Army After Next CSS Franchise Report

INTRODUCTION

Within the broad world of futures research into the Revolution in Military Affairs (RMA), a consensus developed that an RMA will only be possible if accompanied by a simultaneous RML. The participation of the CSS community in the AAN Project, under the franchise leadership of CASCOM, lends further weight to this central theme. In short, it is not likely that the advanced capabilities and concepts projected for the Army of 2025 can be achieved without dramatic, radical changes in military logistics.

This report details the significant discoveries made by the CSS community during the past year in support of the AAN Project and in pursuit of the achievement of the RML that will enable the Army of 2025 to reach its full operational potential.

RESEARCH ISSUES

The research challenge was to examine the strategic, operational, and tactical aspects of deployment, staging, and sustainment of AAN forces. Three specific events during the year provided the opportunity to explore the implications of CSS in the 2025 time frame.

CSS objectives for the tactical wargame (TWG) conducted at Fort Leavenworth focused on determining the elements of a combat-focused sustainment concept that can rapidly and reliably support the tempo of Battle Force operations. The tactical wargame provided unique insights into force structure, support requirements and concepts, and alternative support options. In addition, the game provided the background to explore deployment issues.

However, we also learned that future study efforts must look at CSS as a whole, rather than in discrete operational or tactical segments: CSS in the AAN era is aimed at the seamless integration of support throughout the entire force, across all phases of operations.

CSS questions explored during ARSOF wargame-2 centered on OTM support and the significant changes occurring today in the global economic infrastructure. The game also explored the dramatic growth of nongovernmental agencies and their requirements and unique capabilities.

The Spring Wargame offered the most detailed venue to explore, in a broad and complex situation, CSS issues across all operational areas. The focus, however, centered on deployment, sustainment, and critical CSS issues embedded in deploying both AAN and Force XXI forces. This game also allowed the CSS community to begin the detailed development of issues such as the mobile offshore base. It also explored the force closure dynamics between AAN early-entry forces and follow-on (Force XXI) campaign forces, including the requirements placed on the national-level logistics system and discussions about the merits of a single logistics manager for the entire system.

Each of these events provided specific insights and issues which are discussed in the following sections. However, before proceeding to those discussions, several comprehensive insights covering the entire field of investigation deserve mention.

First, there are three critical CSS constraints that affect all aspects of operations that must be overcome to enable AAN operational concepts:

- All elements of the 2025 hybrid force need to be lightened.
- The enormous demand for fuel and its supporting force structures must be reduced.
- The consequences of significant differentials in deployment and warfighting capabilities between AAN Battle Forces and Force XXI forces must be reduced.

Second, the large number of CSS issues that require investigation demands prioritization of effort and a suitable analytical framework. In response, the CSS franchise established six foundations or pillars of AAN CSS support.

- Power and energy.
- Ultrareliability.
- CSS C^2.
- National and strategic processes.
- Global precision delivery.
- Soldier support.

These pillars are critical elements in changing current operations and processes to support advanced AAN warfighting concepts. They provide focus to our continuing research and also interface with the key elements of the RML and the corresponding RMA. The six pillars are discussed below.

POWER AND ENERGY

Examine the energy requirements for future forces and explore new options and opportunities for energy generation, storage, and distribution.

Throughout every AAN wargame, power and energy were prime considerations in operational decisions and support requirements. The future hybrid force will consume enormous amounts of fuel and energy. The distribution systems and force structures they require are complex, generating significant support requirements. To achieve the capabilities for mobility, agility, and operational reach envisioned for AAN-era forces, we must make significant reductions in power and energy requirements.

REDUCTION OF ENERGY REQUIREMENTS FOR AAN FORCES

The first, critical step in reducing fuel requirements is the establishment of Army goals for fuel reduction. Fossil fuels are expected to be restricted in their availability by the AAN time frame, with oil prices significantly higher. Supplies of fossil fuels must be conserved for use by Force XXI equipment that will co-exist on the battlefield with Battle Forces. Current technologies for increasing the energy conversion effectiveness of gas turbines and advanced diesel engines must increase fuel efficiency of conventional forces.

The number of potential alternatives to fossil fuels is significant, but finding workable solutions presents a formidable challenge. To some extent technology limitations, environmental considerations, and cost frame our efforts. At this time, the most prudent courses of action to guide movement to alternatives appear to be:

- Defining which combat systems are most conducive to alternative source fueling.
- Leveraging industry for the most promising technologies.
- Establishing both near- and long-term goals and standards.

Solar- and nuclear-power applications appear to be the best near-term alternatives, but others are worthy of study and research. An energy-replenishment system that could remotely provide and distribute energy using fewer trucks and pipelines offers promise. Technologies such as ground-based reactor-pumped lasers and high-power microwave systems initially conceived for antiballistic missile defense could be employed as a theater or space-based system. Energy developed at remote sites could be transmitted via laser or microwave to battlefield collection or replenishment locations. Conceptually, an all-electric or hybrid electric ground vehicle could

be inductively recharged at a drive-through site to replenish on-board power pack or energy storage systems.

Remote energy replenishment has already been accomplished via high-powered microwave for relatively low-powered applications such as UAVs. No doubt, there are technology barriers and risks; however, a clear definition of potential technologies and the establishment of departmental energy reduction goals are required.

FUEL SUPPORT TO THE BATTLE FORCE

Although the entire AAN operational construct presents severe challenges to CSS, Battle Force demands for enormous quantities of fuel will be a significant problem. The high numbers of aircraft required for Battle Force vertical maneuver exacerbates this challenge. The initial logistics-support concept developed by the CSS franchise envisioned support from a single base. This now appears tactically and logistically unsound. Cycling large numbers of aircraft through a single refuel point is impractical, tactically unsound, and severely limits operational flexibility. In fact, it invites disaster. The continued use of multiple rearm and refuel locations, carefully sited and supportive of ongoing tactical operations, may be the answer. This issue also requires rethinking aircraft refueling techniques and procedures.

Total fuel requirements can be further reduced through other kinds of reductions including:

- Reductions in the size and number of units deployed on operations.
- Weight and cube reductions for ground combat platforms.
- Reductions in other supply and maintenance requirements (e.g., ammunition).
- Reduction of support processes and infrastructure.

ULTRARELIABILITY

Examine the concept of ultrareliability for military equipment using current and emerging technology and lessons learned from industry.

Research efforts in this area were not as robust as in several of the other pillars. However, like fuels and energy, maintenance is an expensive and enormous requirement driver. We have seen tremendous improvements in almost every commodity and system in civilian use today. The Army has to drive reliability to new standards if we are to lower overall requirements in materials and force structures.

Reliabilities needed in 2025 will be much higher than those of current conventional systems. Increased operational tempo, greatly expanded distances, and the remote self-reliant nature of the Battle Force drive the need for much higher reliability characteristics in weapons and equipment of the AAN. Battle Force concepts of operations presume infrequent failures, most of which will be remedied by crew or operators through modular replacement. However, the capacity to carry large quantities of replacement modules, either on-board or elsewhere within the Battle Force, will be limited. Two primary building blocks are needed to achieve AAN ultrareliability:

- First and foremost, ultrahigh reliability parameters must be built into the systems themselves, beginning with parts and components, followed by component and subassembly integration that is ultrareliable.
- Second, contributions to ultrahigh operational reliability can be made through informed, anticipatory maintenance. On-board prognostics and diagnostics with built-in programmable sensors allow crews to accurately determine the mechanical status of their weapons platforms before failures occur. When a readiness problem occurs through either a failure or combat damage, the crew is alerted and advised of the readiness condition of the system and its ability to stay operational for the battle cycle.

Crew response is key to this approach. The range of maintenance responsibility may be much broader for tomorrow's soldiers. Crew proficiencies must not only include repair skills but also an understanding of on-board diagnostic systems. Repair skills in the future may involve replacement skills at the crew level based on information from prognostics and diagnostic equipment. Operators and crews will have access to on-board spares that may be used to either repair the system or provide a limp-home stopgap.

Of the roadblocks straddling the path to ultrareliability for Army weapons and equipment, existing Army acquisition culture and its governing policies, procedures, and processes may be the most significant. Major changes in this culture and policy are needed to achieve AAN needs for ultrareliable weapons and equipment.

CSS C^2

Explore various concepts of logistics C^2 that will provide insight into the possible C^2 relationships between the various CSS command levels in the future. Identify operational concepts and capabilities that promote the seamless integration of future AC and RC forces.

Logistics Situational Awareness and C^4I Systems

The information technologies expected to be in place in the logistics-support systems circa 2025 will give commanders real-time status of their support posture so they can make decisions based on the current status of the force. Knowledge products will range from complete in-transit visibility of supplies to an immediate, real-time status of all weapons systems. The use of intelligent systems to predict failures will help reduce degradation of effectiveness due to logistics shortfalls. This kind of precise, comprehensive knowledge, coupled with appropriate planning tools and matched with battle rhythm, can provide CSS operators the means to provide the right materiel at the right time and place.

By 2025, CSS communications must also have the same robustness as combat systems. The capability should be sufficient to give logisticians the ability to communicate across all support levels, to the strategic support base, and throughout the civilian infrastructures.

Logistics Mission Planning and Prioritization

Precision operations require precision logistics—providing needed supplies and equipment to the right place at the right time, all the time—based on precision planning. The preceding concepts and emerging insights contribute to successful logistics mission planning and execution. Tomorrow's lean logistics structures and minimum stockage requirements will demand even higher levels of integrated planning. The key element will be to maintain CSS planning, decision, and execution cycles well within acceptable limits of the battle rhythms.

Logistics Cycle Time

The current notion of future warfare suggests a battle rhythm significantly different from today's planning, operations, and support cycles. The Battle Force will engage in high-intensity, time-compressed combat operations. Battles will be short, decisive, and conclusive, thereby reducing the time available for replenishment. While time was allocated for logistics regeneration during AAN game play, the general trend was to recommit the Battle Force before it could be properly completed. Obviously, a more even distribution of battle rhythm (combat cycle to logistics cycle) is required. Follow-on operations during game play must factor in a minimum amount of time for the regeneration of combat power.

Clearly, the logistics planning and execution time have to be shortened to meet operational requirements. Here also, the flow of information is critical. The system can accept and aggregate requirements, find resources, and manage the distribution as long as there is real-time knowledge and situational awareness coupled with assets to move the supplies and equipment. Anything less forces the use of push packages

just to keep within the combat and planning cycles envisioned in the Battle Force. Regardless, time and distance factors still have to be overcome.

Organizations Above Battle Force

Initially, AAN logistics concepts envisioned sustained support to the Battle Force provided by other than Battle Force assets. However, this year's analysis indicates that some organizations will be required to coordinate, provide, and control support to the Battle Force. This organization is especially critical when the Battle Force is employed and a theater logistics structure is not present to receive replenishment for the Battle Force's support unit. As designed, the battle unit support element (BUSE) is not resourced to coordinate the execution of such a wide range of support, especially coming from a multitude of activities. At this point, the organization's function (coordination of support requirements) is more important than size.

National and Strategic Processes

Examine the national/strategic processes that must be in place to support AAN operations. Then we must address the underlying national processes that support the military's warfighting capabilities, as well as linkages with host nation and regionally available commercial support infrastructures. As the system evolves toward global networks of potential service providers, the appropriate term may become OTM.

Tactical and operational logistics are dependent on the strategic base. Accordingly, operational improvements in logistics must be supported by similar improvements at the national level. Some possible improvements are suggested below.

Reliance on OTM Logistics Support

As downsizing of combat formations continues, support structures will be reduced accordingly. Current trends project an increasing reliance on OTM logistics support, including host-nation support (HNS), civilian-based organizations, and regionally available commercial support (RACS). Although the use of such sources to shift the sustainment burden has considerable merit, AAN research suggests that such reliance could involve excessive risk. At question are the robustness of such forms of support and their resilience under the political and operational rigors of a twenty-first century conflict. However, if these challenges are overcome, reliance on OTM support can reduce requirements for organic transportation assets and supply/delivery infrastructure to sustain AAN forces.

Logistics preparations for these types of operations must consider competition for in-theater assets across the interagency and from international participants such as nongovernmental organizations (NGOs) and private voluntary organizations (PVOs). Four important caveats in this area deserve additional study and analysis:

- The military may not have the embedded capabilities to support missions heretofore supportable.
- Civilian agencies and contractors may be fractured across national and political issues and may not support U.S. military and political objectives.
- The availability of OTM assets in potential areas of interest including HNS and RACS may be insufficient.
- The traditional support structure, including just-in-case stocks, should be maintained given the potential shortfalls in OTM support.

GLOBAL PRECISION DELIVERY

Examine the concept of global precision delivery to determine which emerging technologies and systems are viable for enhanced movement and distribution of forces and materials.

Global precision delivery is a broad concept encompassing technology and process solutions to the holistic challenge of global delivery. It includes deploying force packages of personnel and equipment, the follow-on sustainment for that force, and the deployment and sustainment delivery platforms. It also includes the means to

maintain visibility of delivery platforms; the status of personnel, equipment and supplies; and operation of a viable C^2 system. A solid foundation has been laid for the twenty-first century's global delivery systems through the theater distribution and Total Asset Visibility (TAV) programs. As substantial as these and similar programs are, they are not far-reaching enough to ensure attainment of the precision and speed required in the next century.

The Army's science and technology effort identified a number of potential technologies that will markedly enhance precision delivery, especially if they are pursued in full partnership with global industries. The maturation of the global precision delivery pillar can have a positive effect on lightening the force and reducing fuel and energy consumption. Tailored support, precise delivery, and partnership with the commercial sector will also stabilize the number of support personnel required to support the soldier. They will also reduce fuel and energy consumption requirements by eliminating intermediate points in the delivery of that support and by providing proximate facilities. Of the six pillars, global precision delivery appears to be the cornerstone of future support. As such, it must be given the highest priority.

Maximizing Throughput and Follow-On Sustainment

One of the basic tenets of global precision delivery is optimized throughput. The initial Battle Force support concept envisioned that most replenishment would go directly to committed and deployed units using throughput. Trained units can execute throughput with relative ease given a reasonably stable environment and requisite supporting structure.

However, the dynamics completely change for units in combat. Providing throughput to a unit in direct combat with no capability to accept support, such as the Battle Force, is a complex, if not impossible, procedure. Time impacts throughput significantly. Even in 2025, supplies must be on the way prior to a battle without a clear definition of exactly what is required. This dilemma creates a dynamic for pushing support that is difficult to avoid. It also requires support packages to be properly configured to meet operational requirements, with little room for error.

Use of Strategic Assets for Tactical Operations

In the past, force deployment issues surfaced at the strategic and operational levels. With AAN, we are beginning to see a completely different paradigm emerge for the future hybrid force and its accompanying support organizations. Strategic maneuver from garrisons into combat zones means that CONUS becomes the line of departure for deploying units. This change in approach to strategic deployment requires a rethinking of support processes and challenges.

- First, support must be parallel with the tactical force if that force is moving from the strategic base directly into tactical operations.
- Second, what we use as strategic assets to move to an area of operations could also be used to transit the operational and tactical areas.

This dual commitment of scarce resources leaves very little differentiation between strategic, operational, and tactical movement assets, presenting a potential dilemma in management.

DEPLOYMENT AND FORCE CLOSURE

One of the most important challenges facing the Army of 2025 will be to synchronize deployment time lines of the various elements of the hybrid Army to meet strategic maneuver. Force XXI and less modernized forces will not be able to deploy as rapidly as Battle Forces and Strike Forces. Moreover, Force XXI and less modernized forces will continue to rely on deployment systems and processes as we know them today. Sustainment must also begin with the movement of the first combat elements and be integrated within the maneuver and

deployment schemes established for the entire range of AAN-era forces. The inevitable requirement to integrate allies and coalition forces into the deployment and sustainment framework introduces additional, serious complications.

AAN deployments will be complicated by distance and time. The 2025 force must be able to maneuver globally, that is, to maneuver to strategic distances at an accelerated pace. The force will have to move on little or no notice, engage in operations immediately after arriving, and be prepared to continue combat and support operations. Sustainment must occur simultaneously with maneuver and deployment. Together, these parameters drive the deployment process to adopt a point-to-point perspective, rather than the traditional port-to-port process.

The supporting infrastructure required to maneuver forces globally has to be streamlined into a seamless system which allows units to transition through nodes and from mode to mode efficiently. At the same time, Force XXI forces will require more traditional means and processes. The tremendous support requirements of legacy forces will also continue to burden deployment flows.

Other significant challenges include improvement in support planning and the need to protect the deployment system from an expanding array of threats. Stationary targets will continue to abound during the RSOI phase. Ports and airfields are predictable targets, the destruction or denial of which can significantly hinder force projection. Some form of staging base, either ashore or afloat, will contribute to seamlessness and flexibility for movement of forces and sustainment from origin to final destination.

The force closure gap is one of the most important challenges facing the CSS community. Because it represents lost operational opportunities and significant vulnerabilities, it must be resolved. CSS franchise investigation of the force closure challenge will retain high priority in the coming year.

SOLDIER SUPPORT

Examine all issues related to soldier support, including those enduring characteristics of support which are expected to remain unchanged regardless of the conflict.

Enduring Characteristics

The future battlespace will continue to place severe burdens on soldiers and leaders. Human support will continue to consume a large part of the logistics pipeline and the time necessary to accomplish life-support issues. Our moral obligations will continue in the future; care of refugees and prisoners of war will demand the logistician's attention and resources. Even with the most ambitious projections to decrease demands, soldier-support requirements will not materially decrease overall logistics requirements. Improvements and saving must occur in high tonnage areas such as energy and ammunition, not soldier support.

Religious Support to the Force

Like their counterparts have for centuries, AAN soldiers will overcome fear and anxiety through superb training and leadership. The increased battle pace will allow less time for physical rest and psychological recovery; enormous amounts of data generated by modern technologies will increase information overload. Operations in multicultural, multireligious environments will increase stress. The delivery of caring and concerned religious support and pastoral care, grounded in national and Army values, will provide bedrock for individual unit stability under these conditions and reinforce soldiers' faith in themselves and their leaders.

Combat Health Support (CHS)

Meeting AAN mission requirements and reducing morbidity and mortality under future battlespace conditions will require enhancements to Battle Force CHS capabilities. We can do this by merging traditional elements of echelon I-III levels of care and reallocating them within the Battle Force.

This increase in capability must have little or no impact on maneuver capability of the Battle Force. To provide health care for the wounded and maintain maneuver capabilities of the Battle Force, wounded, sick, and injured soldiers must be rapidly and efficiently evacuated. To maintain the health of the force, medical operators must be able to seamlessly integrate Army, joint, and multinational (host nation and coalition) medical assets, see these assets in real time, and have the operational control to employ these assets in the battlespace.

This requires a decision support system which allows medical planners to assemble required CHS based on mission parameters and inventory of CHS teams. The system should have total medical visibility including soldier status, medical assets, and medical logistics. The CHS C^2 infrastructure should also be able to perform coordinated medical management within the theater.

Concurrently, evacuation systems must include state-of-the-art, remotely piloted vehicles capable of both long- and short-range evacuation. Clearly, until evacuation occurs, parallel enhancements in the stabilization and care of critically wounded soldiers are required.

Personnel Support

Personnel support in AAN will provide the commander the ability to man the force and sustain the human dimension of military operations. Personnel support information will satisfy the commander's need to maintain a common relevant picture of the battlespace by providing an accurate, real-time picture of personnel readiness.

Technology impacts on personnel support will mirror the rest of the force and cause a tendency toward the centralization of control and flattening of organizations. This tendency will be tempered by the need to remain responsive to the commander and individuals, as well as to readiness requirements for training and leader development. Some AAN technology innovations may include:

- Eliminating a unique personnel reporting system. Source data entry throughout the soldier life cycle (from recruitment and continuing through separation) will be the norm.
- Replicating data bases will eliminate the need for multiple input.
- Moving the military to second-generation smart-card technology that features passive query capability and automatic recording and updating of soldier information as they pass through battlefield checkpoints. The brilliant card will be used to log on to equipment and weapons platforms to give the commander instant and total personnel asset visibility, as well as crew status and combat power information.
- Allowing soldiers to access, via palm-top computers, personal information stored on brilliant cards. Soldiers may review their records or receive and send mail via worldwide web access. By bringing their lesson in progress when they are deployed away from home station, they take their training with them.

CONCLUSIONS

The first full year of work on the AAN Project has been enlightening and productive for the CSS community. The game venues provided several architectures on which to test new concepts. The CSS franchise continues to work with its component centers as well as AMC and the Logistics Integration Agency (a field operating agency of the Office of the Deputy Chief of Staff for Logistics) to define the relevant issues and to develop the necessary concepts as the process matures.

The issues identified and worked this year yielded a wealth of data, but there is much more to be done. The two major challenges that demand action today are:

- Reducing power and energy requirements across the force.
- Reducing weight, cube, and support requirements.

Unless the Army applies specific measures to achieve significant improvements in these areas, future agility, projectability, and sustainability will be limited to yesterday's standards.

The focus for the coming year will be on further defining and developing the six pillars of AAN CSS. The issues embodied in these pillars will be examined through seminars and workshops, which will complement and add to the larger AAN wargames. The results of this year's study will be a series of manuals to help define those required technologies, systems, and operational doctrines and help focus Army programs and initiatives towards real and substantial change.

Appendix 2
FY98 Army After Next Information Operations Franchise Report

"We were constantly behind the curve...we established in spades that the NCA needs better understanding on how to use IO."

Blue DCI, Winter Wargame 97

INTRODUCTION

As the above quote states, the level of IO play in the first AAN wargame did not raise the issues or provide the insights needed to effectively examine the role of IO in future conflicts. As a result, TRADOC established the IO franchise after the 1997 Winter Wargame to ensure IO is fully and properly integrated into the AAN process. Since then, one overriding theme has clearly evolved: IO will dominate warfare in the 2020 era.

This franchise report highlights FY98 significant activities and presents the insights and discoveries from franchise study and research.

FRANCHISE ACTIVITIES

The IO franchise began last year's activities with the graybeard session in June 1997. The purpose was to discuss the implications of IO in future warfare and to develop a strategy for injecting relevant IO issues into the AAN process. The session raised questions regarding the nature of IO in the 2020 time frame and its application to military operations. A structure to facilitate further discussion of these issues was recommended for the August 97 IO game. Additionally, key participants were prepared for their roles in the following AAN Wargame. From this session, it became clear that IO must be a total, integrated national effort. Also, IO policy, capabilities, and an relevant information and intelligence (RII) data base were prerequisites for successful IO integration in the AAN Summer Wargame. Developing these data became the focus of the August IO game.

The August 1997 IO game brought together experts from government and the private sector to prepare for the AAN Summer Wargame. Work groups developed a draft national IO policy, created a basic IO capabilities tool kit, and introduced an RII data base which would provide response to players' requests for information.

The national IO policy statement was intended to provide national-level players a basis for decisions regarding use of IO and response to an adversary's use of IO. The statement read:

> Information operations are legitimate elements of U.S. National policy in peace and war. In so much as the National Information Infrastructure is an element of National Power just as the military, the economy, etc., any attack on that infrastructure is an act of aggression and will be met with the appropriate response.

Included within this national information infrastructure are:

- National transportation networks.
- National energy supply and distribution.
- DOD information systems and networks.
- Government agencies.
- National communications networks.
- National and international financial networks.

The tool kit provided a basic list of emerging technological capabilities which experts projected could be available in the 2020 era. These capabilities were grouped into the areas of—

- IO protect.
- IO attack.
- Exploitation.
- Force protection.

These capabilities provided a basis for players to design a campaign with achievable objectives consistent with assumed capabilities.

The RII data base provided the players with information regarding friendly, adversary, and neutral entities to support IO planning.

The IO game familiarized players with the AAN process; ensured that the policy, tool kit, and data base were effective tools for AAN game play, and, most importantly, raised issues to be introduced and examined in the AAN wargame.

Seven main insights emerged from the game:

- IO is applicable across the spectrum of conflict, at all levels of war.
- IO is never in reserve.
- Military IO requires pre-existing national IO policy.
- Effective execution of the wartime IO campaign requires peacetime preparation and may involve some political risk.
- Due to the nature of the global information environment, national and theater IO activities are intertwined and must be mutually supporting.
- The CINC may never have complete control of IO in his area of responsibility, particularly when vital interests/national survival are at risk.
- Precision intelligence orders of a magnitude beyond today's capability are required; intelligence must address the human dimension with the same precision given to technical systems.

Three ISR issues, as a subset of IO, also emerged from the August game:

- ISR capability must be preserved, to include terrestrial and space-based capabilities.
- IO intelligence preparation of the battlespace is critical.
- The means and methodology to assess IO effects beyond physical destruction are vital to the commander's decision-making process.

IO play grew tremendously during the Summer Wargame. Although prepared with a policy statement, a capabilities tool kit, and readily available RII, IO did not fully mature into a dominant force on the battlefield. Players still prone to debate the policy were therefore hesitant to implement IO plans and activities. However, this debate and the IO activities that were conducted did produce relevant IO emerging issues:

- IO is an integrated set of enablers that significantly impacts the outcome of events at the strategic, operational, and tactical levels of operations.
- Military IO is conducted in peace and war and requires established national IO policy and procedures.
- Effective IO demands integrated, focused, and precise C^4ISR across the full spectrum of operations, achieved by leveraging interagency, space, joint, combined, and tactical capabilities.
- IO requires a focused approach similar to maneuver, firepower, and intelligence.

The issues emerging from the 97 game formed the basis for the IO franchise objectives for FY98. The franchise designed its activities to answer the question, "How do we integrate the

spectrum of information capabilities into a cohesive IO campaign that creates the desired level of information dominance?".

FEBRUARY 98 GRAYBEARD SEMINAR

In preparation for the FY98 games, the franchise refined the national IO policy. The February 1998 IO graybeard session was tasked to address this draft national IO policy in preparation for the AAN Summer Wargame. Specifically, the session examined two main questions. First, what authorities should be delegated to the Secretary of Defense in wartime to provide effective IO direction at the national level, and second, what wartime IO authorities should the Secretary of Defense delegate to the theater CINC? Highlights of the discussion were:

- The IO policy statement developed last year is basically sound.
- Though it must encompass DOD, IO policy and strategy goes beyond the military; it is a national issue.
- The CINC's wartime authority should include the authorities to conduct IO within his capabilities. Policy must establish ROE that define his constraints/restraints.
- Status of civilian systems, networks, etc., vis-à-vis ability to prepare for and/or conduct IO, must be defined. In the future, isolating the military information environment from the civilian will be difficult.
- The CINC requires real-time dialogue with NCA regarding IO strategy, facilitating his support requirements, and acting on his requests regarding ROE.
- IO activity must be considered in peacetime and not just in wartime. What preparations must take place in peacetime to enable wartime IO (if any)?

At the close of the graybeard session, the TRADOC DCG directed the IO franchise to develop an IO organizational construct for the Spring Wargame with two core features:

- Design an interactive process to allow constant and routine CINC participation in national-level IO policy and strategy discussions.
- Develop STARTEX IO policy and ROE that enable the CINC to consider IO in his campaign planning and to use it effectively in the execution.

MARCH 98 IO GAME

The IO game conducted 16-19 March 1998 was the second step toward integrating IO into the FY98 AAN cycle. The game built upon the graybeard seminar conducted in February 1998. That seminar emphasized the need to empower the CINC to use IO as an integral part of the campaign. The IO game objectives were to—

- Discuss and refine national policy.
- Discuss and develop ROE.
- Discuss and refine the IO capability tool kit.
- Implement the IO element of the national operations support team (NOST) and exercise game play procedures.
- Establish and exercise assessment procedures and criteria.
- Discuss and exercise ISR game play and assessment procedures.
- Recommend STARTEX IO conditions for discussion at pre-SWG political/military game.

A draft paper addressing these areas was given to the participants in the IO game for discussion and comment. A separate work group formed for each topic to discuss and provide a refined draft product. Policy, ROE, and capabilities were defined for both sides of the upcoming Spring Wargame. Results of the discussion/work groups are summarized as follows:

Blue IO Policy

A formal policy statement legitimizes IO as an instrument of U.S. national policy in peace and war and defines the information infrastructure as an element of national power, thereby reserving the right to respond appropriately to any attack upon that infrastructure.

Blue IO ROE

Initially, ROE are characterized by increasing delegation of authority to the NOST and the CINC during periods of crisis and transition to war. In wartime, the CINC is free to conduct all legal IO activity within his capabilities.

Red IO Policy

Red policy is to "take whatever offensive and defensive IO actions necessary to influence other nations, such as to enable us to execute our national religious, political, economic, social, and military objectives—without risk of direct confrontation with, or retaliation by, other nations."

Red IO ROE

Red ROE centralize control of IO with the national command. In the absence of military operations, all IO activity is on order of the national command. Once military operations are authorized by the national command, high commands are authorized to undertake all IO activities against targets in their areas of operation.

Blue versus Red

Principal differences between Blue and Red policy/ROE are the freedom of action allowed the Red national command in pursuit of higher national objectives imperative to act within the legal, moral, and ethical restrictions demanded of the U.S. At the other end of the spectrum, Red ROE clearly restrict the high command to IO activity within their areas of operation while ROE drafted for the Blue side place no such restriction on the CINC. The exercise also demonstrated that, although Blue forces may have superior C^4ISR and IO capabilities, they may not gain information dominance without flexible ROE and expeditious authority to employ their tools.

Organization and Procedures

The concept of the NOST was presented and discussed. The NOST will be a multidiscipline team providing interface between the NCA and the CINC. The IO staff element in the NOST will support the CINC with interpretation of national policy issues, coordinating CINC IO activity with other agencies conducting IO at the national and regional level, coordinating IO support from other agencies at the request of the CINC, and approving CINC IO activity when required by the ROE.

IO Capabilities Tool Kit

The tool kit was the linchpin that would enable effective operationalizing of IO in the SWG. The ROE were not relevant until a relationship was established between what you may do (ROE) and what you can do (tool kit). The tool kit established the capabilities of all players in the game. Each capability had an associated effect (probability of success, duration of effects, etc.) which provided for consistent assessment and a basis for comparison when determining outcome of Red vs. Blue activity. A well-defined tool kit with consistent outcomes enabled a defensible assessment that could then relate IO actions to a penalty or benefit in the overall campaign assessment.

Intelligence, Surveillance, Reconnaissance

Emerging ISR issues from the Summer Wargame were presented and discussed. ISR emerged as a critical player in the Summer Wargame. This resulted in adding an ISR special cell for the SWG to assist in assessing ISR activity while overwatching ISR game play to provide supportable emerging ISR issues based on game play vignettes. The AAN response cell (not strictly an ISR element) exercised its information data base and tested formats and procedures for answering requests for information from all player cells.

Preparation and Team Building

Though an intangible, this is the area where we enjoyed perhaps our greatest success with the most benefit to the Wargame. The IO game participants going to the SWG heard and discussed the key IO enablers in the SWG and then worked with these policies, ROE, tools, et.al., in a game turn. This understanding of AAN, the scenario, and the role of IO helped to achieve the DCG's guidance to "operationalize IO" for the SWG.

SPRING WARGAME

The real highlight of 1998 was IO play in the Spring Wargame. The franchise's objectives were to provide integrated support to the wargame and to establish IO/ISR as an important capability. We met those objectives. The latter objective was more important because it would "operationalize IO."

IO was such a part of the game that Blue eventually gained full information dominance, but Red and Orange used IO effectively as well, especially early in the game. The franchise assessed that IO tools placed an overhead on computer networks and processors that reduced efficiency by 40 percent overall and extended planning and execution cycles by 25 percent.

Despite the integration into the Spring Wargame and the overall activity of the franchise during the last 12 months, there are emerging IO impressions that warrant further investigation in the AAN process.

- Information dominance establishes conditions for combined arms success across the full spectrum of operations, to include countering asymmetric threats. This is especially true for power projection. It requires processing and making sense of a large and diverse information set well before soldiers are on the ground. Information dominance ensures communications networks are robust enough to keep the deploying force aware of situational changes. Information dominance also lets the commander determine the right move to preempt a real crisis—the wrong move could set it spinning out of control. However, information dominance is attainable only if the IO campaign is focused on the overall campaign objective. For instance, Blue planned to attack Red units as they moved out of defensive positions, but denied Red the necessary C^2 architecture to order those movements. Blue also struggled to define potential pre-delegated authorities for applying space and IO capabilities, and Red was able to conduct pre-planned operations despite Blue C^2 efforts.
- IO has a global effect. Red and Orange waged a propaganda war to influence international opinion of Blue operations. Also, any use of space ISR assets to support IO in homeland defense could degrade theater satellite support. Such a diversion of assets could create an exploitable vulnerability elsewhere.
- A major IO emerging impression is that simulation-based training is critical. Simulations allow IO training to be conducted in realistic settings.

The Spring Wargame effectively demonstrated the importance of IO in the 2020 era. As Blue CINCWEST noted in the senior leader seminar: "IO is everybody's business; it is a campaign in itself; and information dominance enables proactive vice reactive operations."

Appendix 3
FY98 Army After Next Special Operations Franchise Report

INTRODUCTION

As the AAN Project special operations franchise holder, the U.S. Army John F. Kennedy Special Warfare Center and School (USAJFKSWCS), in conjunction with TRADOC, sponsored two ARSOF wargames. ARSOF Wargame-1, 29 June to 3 July 1997, assessed the dynamics of warfare for less-than-vital interests and identified characteristics of warfare as they apply to intrastate conflict in the future. ARSOF Wargame-2, 22–27 February 1998, continued to examine conflict where less-than-vital U.S. interests were at stake, in an environment classified as a complex contingency operation as defined by Presidential Decision Directive (PDD) 56. The scenarios in both games centered on a sophisticated Information Age insurgency, basing its power on information and economic power through pervasive links in the global economic and information infrastructures.

RESEARCH ISSUES AND DISCUSSION

ARSOF WARGAME-1

Wargame-1 explored technology impacts on future intrastate warfare, but focused almost exclusively on advances in information and communications technology. Weaponry, mobility, electronic surveillance, and other potential technological advances were not ignored, but did not receive adequate attention for analysis.

Technology

Two core impressions regarding the role of technology in future conflict emerged from the game. First, technology should be viewed as a neutral tool that does not intrinsically favor either side over the other. Comparative advantage comes from the skill and application of the user, not the technology itself. Second, although technology may not change the fundamental nature of future intrastate warfare, advances will affect the character of intrastate dynamics, i.e., how conflict is conducted. Human considerations, vice technological advances, are likely to remain paramount in future complex contingencies.

Legitimacy

Technological advances should have little impact on the fact that overt, legitimate governments, able to maintain the moral high ground, will retain a clear operating advantage over insurgents. However, intelligence gathering, communications and psychological operations will take on dramatically new forms. Detecting and countering disinformation and misinformation, protecting critical systems, and tracing the activities of opposition elements will be critical but particularly challenging in the future.

Weapons of Mass Destruction

Although the use of WMD was not a major factor in this game, it became an issue at the post-game senior seminar. The use, or threatened use, of WMD may give an insurgency influence disproportionate to their level of popular

support; possession might radically alter the balance in future conflicts. The subject requires a separate excursion to support the technology azimuth of AAN.

Sociopolitical Literacy of ARSOF

Operations other than war (OOTW) require more than just understanding military art and science. It will be increasingly important for ARSOF cadre to remain well informed and cognizant of all the environments in which they operate. In addition, they should be knowledgeable of U.S. history and political systems if they are expected to influence other peoples to follow our example. U.S. regional commanders will rely on ARSOF to conduct strategic-level assessments in complex, multicultural, and multidimensional environments. Accordingly, ARSOF must assimilate all-source information and quickly distill it into a form of ground-truth awareness that is relevant to the supported commander.

Role of ARSOF in AAN—Global Scouts

The ability of ARSOF to operate in all environments, across the entire operational continuum, may contribute significantly to a resolution of OOTW conflicts where low-tech solutions, vice high-tech capabilities, are particularly effective. Moreover, if U.S. diplomatic and military presence overseas continues to fall, ARSOF activities outside CONUS may become a critical means of maintaining physical contact with possible deployment areas. Herein lies the origin of the global scouts role: ARSOF, given their appreciation of the environment, technology, and characteristics of the population, located on the ground prior to crisis or conflict, provide U.S. regional commanders with unique capabilities for assessment and early action.

Soldier/Leader Development

High-quality training, education, and leader development remain vital for ARSOF at all levels, based on the principle that leaders should be trained for certainty but educated for uncertainty. ARSOF must also maintain its traditional reliance on high-quality personnel. The future demands ARSOF attributes such as integrity, emotional stability, high physical and military tolerance for stress and ambiguity, self-discipline, self-confidence, the ability to deal with complex situations and make good decisions with incomplete information. In addition, the future ARSOF team must adapt to nontraditional missions for which no precedent exists.

ARSOF WARGAME-2

Wargame-2 explored two specific objectives: the nature of complex contingencies and future intrastate conflicts and the roles and functions of the military during regional engagement. Guided by a focused set of research questions, the following impressions emerged:

An Untidy World

Future conditions endemic to complex contingencies may appear to be unstable, volatile, and even uncontrollable from the U.S. perspective. Yet, they may be entirely acceptable and normal within the context and bounds of foreign cultures. The U.S. will increasingly be faced with difficulty in determining which situations represent actual threats to our vital and less-than-vital interests.

Complexity

Operational environments will likely become more complex. The number and type of significant players will increase. Governmental and nongovernmental players will proliferate. Hybrid and irrational actors may become common, prominent participants. Combinations of national states, political movements, international organizations, and criminal transnational interests will continue to permeate the battlespace. Interaction between potential partners will be complicated by institutional biases, conflicting objectives, and divergent purposes.

Obstacles to Effective Interagency Operations

Wargame-2 demonstrated the distinct and divergent cultural viewpoints between the Department of State (DOS) and Department of Defense (DOD). While DOS is process oriented,

DOD is clearly objective oriented. Other agencies fall between the two. Additional obstacles are described below:

- *Doctrine and terminology.* Within the interagency framework, lack of common doctrine and terminology, coupled with divergent views on operations and training, leads to misunderstanding, ineffective cooperation, and less than optimal unity of purpose and effort.
- *Purpose/Intent.* Military personnel associated with the game tended to view complex contingencies as opportunities that could be exploited to gain operational leverage in achieving larger objectives or to facilitate other ongoing or future operations. In contrast, players representing perspectives of the DOS and humanitarian relief organizations (HRO) advocated constrained operations, with activity limited to those actions directly contributing to the success of the specific mission. Purity of purpose and consistency of intent were considered to be absolute, constant, uncompromising, and essential parameters for execution of humanitarian relief operations. Mission creep in peacekeeping operations (PKO) or HRO missions on the part of the U.S. Government, whether intentional, voluntary, or mandated, was viewed as a breach of purpose. Additionally, a broad spectrum of players raised core questions about the role of the military in OOTW.
- *End State.* End states are difficult to define; consensus is elusive. Moreover, aligning the operational mission with the desired political end state is not easily accomplished. The lack of clarity regarding military responsibilities in reconciling objectives negatively affected mission planning and performance in this game. No formal mechanism for resolving such conflicts appears to exist. This impression highlights a potential issue for future interagency work groups.
- *Political/Military Plan.* The general political-military plan developed in support of PDD 56 and employed in this game was generally received as a significant step forward in formalizing the interagency process and was accepted universally as an essential requirement for integration.

Standing Joint Task Force (JTF)

A requirement for standing JTFs for regional engagement was frequently discussed; some consensus arose that a core standing element was required. The game play demonstrated that the regional CINC's Special Operations Command (SOC), given its expertise for regional engagement operations, combined with requisite transition capability to become a deployable, tailorable joint force headquarters, may be a suitable foundation for future JTFs.

Destabilization

The third scenario played in ARSOF Wargame-2 addressed destabilizing an insurgency. Specific tactics employed in this type of operation involved three distinct phases, each with significant implications for AAN capabilities and concepts.

- Preparation phase. This phase involved a worldwide, interagency effort to track, locate, and neutralize leaders, criminal activities, and assets. Challenges to this interagency effort include the unprecedented degree of cooperation required and concerns as to the appropriate roles and functions of various agencies in such operations. In-country operations, necessarily bi- or multilateral, were deemed important in tagging leaders, criminal activities and assets, and military and paramilitary organizations.
- Main effort. The preparation phase laid the foundation for a coup de main in the target territory, conducted in conjunction with neutralization of the insurgent global infrastructure. The operation was viewed as a short-term, simultaneously executed set of synchronized strikes capitalizing on shock and overwhelming, but surgical, force.
- Follow-up actions. The host nation should assume responsibility for post-strike stability operations, thus establishing

legitimacy for the preceding main effort. The U.S. then transitions to a supporting role that could take multiple forms, ranging from a JTF to a joint interagency task force. The nature of the latter organization merits further study.

COLLECTIVE INSIGHTS

These issues represent the most important collective insights derived over the past year from ARSOF participation in the AAN Project. They represent topics considered worthy of further research and serve as input for future game design as well as a focus for evolving scenarios and research questions.

REGIONAL ENGAGEMENT

Collective experience from game play demonstrates a clear need in the future for regional engagement forces (REF). Regional engagement operations will shape the battlefield of the future and present a means of containing or defusing situations before they escalate into major contingencies or war. REF will need to be increasingly competent in the interagency arena and configured to maintain formalized relationships with a wide array of agencies. A modular force structure, possibly built around an SOC for C^4I, would likely enable force tailoring appropriate for each scenario.

INTERAGENCY OPERATIONS

Within the context of regional engagement, interagency processes dominated all aspects of operations, regardless of which agency had the lead role. To effectively conduct regional engagement operations, the AAN should be organized, trained, and equipped to operate as an extension of the interagency process. Leaders must be educated and aware of the demands of integrated operations.

SOF ROLES

SOF are uniquely suited to play key roles in C^4ISR and in the execution of regional engagement operations in the future. SOF familiarity with the interagency environment, coupled with their regional focus, multinational experience, and professional education and training, render these forces well matched for the requirements of future regional engagements.

ENABLING TECHNOLOGIES

U.S. participation in future regional engagement and complex contingencies could be enhanced through the development of the following enabling technologies:

- C^4ISR Architecture. The increasing demand for information over an ever-expanding spectrum of topics presents a significant technological challenge for the AAN. Comprehensive, precise collection, coupled with significant advances in information processing, distribution, and planning are required.
- Force protection. Force protection against military and nonmilitary threats presents equally daunting challenges for the future Army. Identifying threats and mounting effective counteractions will be increasingly difficult in an environment characterized by widely available advanced weaponry and technology.
- Sustainability and logistical support. Providing sustainability and logistical support for complex contingencies, while reducing the footprint in the focus area, will strain emerging technologies to the utmost.
- Nonlethal capabilities. Nonlethal capabilities may present force options more acceptable in the world of 2020.

HUMAN FACTORS

Human factors continue to be paramount in the conduct of regional engagement and complex contingencies. Advanced technology will support and enhance U.S. military capabilities in these operations, but human dimensions, including human intelligence, training, education, and cross-cultural skills, will remain fundamental to success. The training and education requirements surfaced during game play involved producing leaders and operators

(both within the military and in other agencies) competent in the interagency and intercultural environment. The ARSOF-like nature of such professional development was highlighted.

THE ROAD AHEAD

As an integral part of the Army combined arms team, the U.S. Army Special Operations Command (USASOC) recognizes the need to be fully integrated into concepts for future land forces. The USAJFKSWCS continues to focus on intrastate conflict, human considerations, regional engagement, and the participation of the military in OOTW. The future events described in this section represent the continuing commitment of USASOC and the USAJFKSWCS to the AAN Project.

ARSOF WARGAME-3

The ARSOF franchise will continue its investigation of intrastate war through the conduct of ARSOF Wargame-3, 18-23 October 1998. The game will be preceded by a pregame workshop to review fundamentals and to provide an opportunity for key game participants to become familiar with the theoretical and operational constructs of the seminar wargame. Wargame-3 will continue the examination of U.S. responses in internal conflict and explore possible roles and missions of Army and joint SOF.

SERVICE GLOBAL WARGAMES

The USASOC will broaden its futures research through participation in the Navy's global wargame and the Air Force's global wargame series. Additionally, USASOC plans to conduct an internal tactical wargame in the early second quarter of FY99. This event will explore the future potential of ARSOF employed in reconnaissance, intelligence, surveillance, and target acquisition and coalition support activities. Our intent is to use this wargame as a foundation for ARSOF participation in the 1999 AAN strategic wargame.

Appendix 4
FY98 Army After Next Space Franchise Report

INTRODUCTION

This report documents the activities of the AAN space franchise over the period July 1997 through June 1998. The main objective of this report is to capture key insights, impressions, and issues discovered during franchise activities. A secondary objective is to project the franchise's planned activities for the next 12-month period.

TRADOC established the AAN space franchise after the 1997 Winter Wargame to maintain momentum established during the game and to establish a vehicle for continuous critical review of space-related insights, impressions, and issues. The franchise has been instrumental in shaping the Army's view of the nature of future warfare. In the past 12 months, the franchise executed two major franchise activities (an IIT meeting and a wargame) and participated in two major TRADOC wargames (Summer 97and Spring 98). Elements of the franchise also participated in three other franchise activities—IO and SOF games/ activities—as well as several other Service (Navy Global 97 and Air Force Global Engagement 97) and DOD games. In addition, the franchise completed extensive research and analysis related to the space force structure used in AAN activities; developed a National Space Policy for the year 2020; conducted a review of applicable international law, treaties, and agreements; and established partnerships with industry that provide insights into the potential future commercial space environment.

BACKGROUND

The mission of the space franchise is to build upon previous findings and to continue to examine the effect of space on land warfare in the 2020-2025 time frame. Results of these efforts will be provided to Army senior leadership and key decision makers associated with other functional areas affected by space operations. A primary goal of the franchise is to educate activity participants and senior Army leaders and staff on findings pertaining to space doctrine, policy, and capabilities.

The U.S. Army Space and Missile Defense Command (SMDC), in conjunction with TRADOC and the National Reconnaissance Office (NRO), executes a series of space games to focus on space-related issues arising from the AAN process. Future space games may also include missile defense issues. The object of each space game is to provide the Army leadership strategic and operational insights on the effect of space on land warfare in the 2020-2025 time frame.

The number of space and missile defense issues raised in futures wargames and events each year precludes focused efforts on each and every documented insight or impression. SMDC has generated more than 75 space-and-missile-defense-related issues, insights, and impressions from the first 18 months of AAN activities. Each year, data from AAN efforts will be added to relevant, previous year data. Given this volume of data, SMDC needed a streamlined mechanism in place to analyze all applicable data and determine the information that captures the essence of a larger set of more focused issues. The S/MD IIT was formed to perform this function.

The S/MD IIT serves as SMDC's long-range engine of change. Inputs to the S/MD IIT include AAN wargames and other Army, Service, DOD, governmental, and commercial 2020 time frame activities. The S/MD IIT seeks to develop breakthrough or leap-ahead space and missile defense capabilities.

IMPRESSIONS, INSIGHTS, AND ISSUES

SUMMER WARGAME (September 1997)

The space impressions, insights, and issues coming from the Summer Wargame (September 1997) were limited, but important. Game play illuminated the potential impact that commercial space services could have on future warfare, creating an impetus to begin a detailed research effort on commercial space systems that will be available to future warfighters. The research led to the establishment of partnerships between the space franchise and members of industry that have had significant impact on all franchise activities.

The adversary in this game was a sophisticated, Information Age insurgency, operating as a space-player without owning any space-based assets. Use of personal communications services, commercially available imagery, and precision navigation services enhanced their political, military, and economic might, permitting them to challenge the U.S. in these areas of national power.

SPACE/MISSILE DEFENSE IIT

The first IIT was organized to explore policy, concepts, and technology insights in a seminar environment and to address implications of the following three issues:

- How will friendly and adversary use of commercial space systems impact the military decision-making process and resulting military operations in 2020?
- How do we integrate space operations with the theater CINC's operations in 2020?
- What is required to assure mission support from space in 2020?

The IIT was conducted from 9-11 December 1997 at the conference facilities of the U.S. Army Topographic Engineering Center (TEC) located at Fort Belvoir, Virginia. The IIT discussions resulted in five recommendations, synopsized below, that had a significant influence on the content of many subsequent events. Additional details on the conduct of the IIT are available from SMDC.

Recommendation 1, Technology Panel

Develop technologies to temporarily deny space-imaging systems within a terrestrial theater of operations. AAN forces will be subject to robust overhead imagery from a number of commercial and military/civil satellites. The imagery from many of these systems will be available to any party with internet access and electronic credit. To deny imagery services to potential adversaries, it may be necessary to employ space-control methods. These methods could include diplomatic measures to prevent imaging over a specific geographical area or to deny products to an adversarial party. Space control methods could also include deception, disruption, denial, degradation or destruction of imaging satellites. However, as described further below, the effects of permanently disabling a satellite can easily extend beyond the theater of operations and include escalatory political and economic ramifications. Therefore, it appears inappropriate for a terrestrial theater CINC to engage in space-control measures of a permanent nature. Negation measures with temporary effects appear to be more applicable to a theater situation.

Recommendation 2, Technology Panel

Investigate DOD enhancements to commercial satellite systems. The commercial-space sector is growing at a tremendous pace. New constellations of satellites provide worldwide communications coverage with cellular phone-size handsets. Imaging satellites operate in the visible, infrared, and radar spectrums, and some will operate in multiple spectral domains. There may be opportunities for DOD to influence the design of these commercial systems in ways to satisfy military requirements while not affecting, and possibly even increasing, the commercial viability of these systems.

Recommendation 3, Policy and Concepts Panels

Establish a CINCSPACE team with space assigned as an area of responsibility for space game 2. In the 2020 time frame, the use of space systems and services, to include weapons that could be based in or influence spaces, may be significantly greater than their present use. The growth in economic and military reliance on space systems will generate requirements to protect U.S. and allied space capabilities and to deny the same to an adversary. The global nature of the space operational environment also strengthens the idea that it may be more efficient for CINCSPACE to centrally manage space operations.

Recommendation 4, Policy Panel

Establish space policy and ROE for use in Space Game 2 and subsequent wargames. The space policy played in the AAN Winter Wargame and Space Game 1 did not prohibit the U.S. from taking the first shot in space. However, NCA stated the U.S. would not do so, despite the presence of a near-peer adversary possessing space-control capabilities, which the enemy did in fact employ to gain some significant operational advantage before the U.S. could respond. Given this resistance, an alternative policy was developed for use in Space Game 2. That policy simply omitted any mention of the first use of space-control weapons. Development of the associated ROE was left for CINCSPACE to accomplish at the space game.

Recommendation 5, Concepts Panel

Transition from information-based warfare to knowledge-based warfare. As the world progresses towards 2020 and commercial space services become more common and affordable, potential adversaries will purchase the types of information and information services that only a few countries can afford today. The result could be a decrease in the information advantage the U.S. has over a future adversary. If a narrowing of the capability gap is assumed, then the future advantage may lie with those who can make best use of the information through superior and more rapid processing. Also, raw information must be processed into knowledge in a form that shortens the decision cycle and is dynamically tailored to the changing requirements of the users, creating cognitive multiplier.

SPACE GAME 2

Space Game 2 was conducted from 28 January to 5 February 1998 at the Army Space Command Headquarters in Colorado Springs, Colorado. SMDC, TRADOC, and NRO sponsored the game. The Space Game 2 scenario elements were designed to address the following five research areas:

- Space operations synchronized in a cohesive theater campaign.
- Land, air, sea, and space integration.
- Space policies.
- U.S. space order of battle.
- Major competitor capabilities.

Observations of the players, facilitators, and game developers are organized below in three main categories: space literacy, space integration, and commercial space. The details of the game and its findings are available in a Space Game 2 final report published 17 June 1998.

Space Literacy

AAN efforts to date indicate a need for space-related education for players and game developers as well as current and future civilian and military leaders. Three areas, in particular, require focused efforts to prepare game participants for optimal game play:

- Education is required so players and assessors understand the contents and intent of the 1996 National Space Policy.
- The impact of commercial space services on future warfare, in general, and space operations, in particular, must be clearly understood.
- Industry's intent with respect to space-system protection and space operations needs to be expanded.

Placing the players and assessors on a common educational foundation had a positive impact on the game. The increased emphasis on education resulted in reduced decision time lines at the NCA level, better operational awareness on both the Space Command and regional CINC teams, and greater participant understanding of what space could provide to enable and enhance future warfighting concepts. Three examples of initiatives taken during Space Game 2 include—

- Training was conducted one afternoon and one morning prior to game play.
- Game developers used industry partnerships to enhance the training value of Space Game 2. Players attended lunchtime training sessions conducted by industry partners.
- In addition to the briefings, industry representatives participated in the game as players. Their contributions are described in the Commercial Space, Space Game 2 final report.

Space Integration

Recognizing that the traditional air, land, and sea domains must be integrated with the emerging space and IO domains, Space Game 2 incorporated a fundamental change in integrating space operations into a total force concept. The game demonstrated that force-structure and command-structure changes might help to achieve total force integration. Space will continue to be a key enabler and integrator of core functional capabilities, including positioning, communications, and situational awareness, across joint forces and levels of war. However, space systems do have limitations; a complementary suite of terrestrial capabilities, more vulnerable than space components, may be required.

The ISR architecture played in Space Game 2 included robust tasking authority and direct downlinks (DDL) from space-based assets to the theater operations centers. It appeared that these direct and streamlined tasking and data dissemination capabilities provided significant advantage to the Blue forces and greatly enhanced the integration of space operations with the CINC's terrestrial operations.

Commercial Space

The digitization of the battlefield down to the individual soldier level in ground warfare requires a tremendous amount of bandwidth. When considering the other warfare areas and their bandwidth requirements, a mixture of both space-based and terrestrial communications may be required. Due to the complexity of future space architectures, sophisticated automated decision support and planning mechanisms may be needed to fully leverage space technology.

The availability of commercial imagery and communications to a potential adversary may present a set of complex problems for future NCA. Commercial space systems will serve a variety of global customers to include potential adversaries, an observation verified again in the Spring Wargame. Denying these capabilities without affecting friendly or other users may be technically difficult or impossible due to the design of some systems.

SPRING WARGAME 98

Some of the ideas and concepts from Space Game 2 were carried over into the larger context of the Spring Wargame. Both games included a CINCSPACE player/cell, with space played as an area of responsibility. In addition, all space

forces, to include national security space systems, fell under CINCSPACE control. CINCSPACE apportioned and allocated space forces to the terrestrial theater CINC as well as to national-level customers. Key insights are summarized below:

Authority

The question of who should control theater-deployed space-control assets was discussed between the CINCSPACE and CINC West teams. CINCSPACE's position was that CINCSPACE owns all space-control assets and controls all systems, even those deployed to a terrestrial theater. CINC West felt that he should control those within his theater, particularly those that have a temporary effect, since CINC West has to manage the movement, protection and supplying of those systems. It was suggested that the hard- vs. soft-kill nature of some of the weapons could determine who ultimately has trigger control.

The game also explored the question of pre-delegation of authority by the NCA to CINCSPACE to employ space control, national missile defense (NMD), and force application assets. Although Blue space systems were never seriously threatened in the Spring Wargame, this predelegation provided a basis for CINCSPACE to rapidly respond to threats.

Escalation

Blue deployed laser blinders/dazzlers to the CINC West area of responsibility and told national and commercial space-system operators they would be blinded if they imaged the Blue forces in theater. Russia and China issued warnings that they would retaliate for such action. When Blue blinded all offending satellites, Russia responded by blinding Blue imaging satellites over Russia. China also blinded Blue satellites over China, but stressed that its imaging satellites were not to be interfered with by any country. China also used its ground-based laser to destroy one of Blue's imaging satellites. France interpreted this action as an escalation outside the immediate theater and pulled out of the Blue-led coalition. This sequence of activities showed the potential for low-level (degrade, deny) space-control measures to escalate, even to nonbelligerents.

Restraint

On the other hand, Spring Wargame play also highlighted an increasing awareness to preserve space for use by all nations. Even though Blue and its adversaries possessed varying space-control capabilities, both sides showed restraint in using space weapons, particularly those that would cause debris or radiation damage. Red's NCA chose not to use their one antisatellite (ASAT) system (nuclear IRBM), because it would have destroyed a large piece of the international banking/finance infrastructure on which they depended—a drastic change in perspective from Red views in the 1997 Winter Wargame. However, we must not assume that future adversarial NCAs will take the same rational approach to this warfare issue.

Integrated Planning

The robust ISR architecture played in the Spring Wargame was vital to Blue's information dominance. It provided a second data point to understanding how direct tasking and DDL architecture could play a significant role in the operation of space services and the overall integration of space operations with terrestrial theater operations.

The game also provided evidence that integrated joint planning is becoming more common. CINC planners were clearly sensitized to the benefit of integrating space operations into each phase of the overall campaign plan

Missile Defense

The Spring Wargame played a multitiered missile defense (space, air, upper tier, and lower tier) that was very effective. The space systems (space-based lasers and kinetic-kill vehicles) provided worldwide coverage and rapid response times, but there were exploitable gaps in their coverage. The air systems (airborne lasers and aircraft) provided a rapidly mobile capability, though limited in range. The ground- and sea-based upper- and lower-tier systems

were very effective, mainly due to the large number of systems and missiles available, though their mobility was limited. An optimal mix of these different systems requires future analysis.

The Spring Wargame included the unprecedented use of Blue NMD systems in a theater missile defense (TMD) role. During the first attack of the wargame, the space layer was not employed to defend in-theater missile attacks because NCA policy desired to reserve it for CONUS defense. After the initial attack, the NCA reassessed their policy and allowed an allocation of the space layer to TMD. With the addition of the space layer, TMD effectiveness approached 100 percent.

A game crisis between India and Pakistan, which escalated to the point of a theater-ballistic-missile exchange, also raised some operational and political questions on the potential role of Blue space-based NMD assets to control third-party employment of WMD. The engagement of missiles in space side-stepped significant issues of sovereignty. The India/Pakistan events also highlighted the reach that space systems offer to affect conflicts outside the capabilities of other forces. Although the issues raised during this dispute were not fully explored, the use of space forces for TMD demonstrates an additional return on investment for the space infrastructure necessary to accomplish NMD.

SPACE POLICY AND SPACE FORCE STRUCTURE DEVELOPMENT EFFORTS

SPACE POLICY

The space policy review conducted after the Spring Wargame resulted in a determination that the current U.S. National Space Policy adequately addressed many of the issues identified previous wargames. A few areas need amendments to address the changed threat and updated force structure played in the wargame scenarios. The need for education on space policy has already been cited.

With respect to international policies and agreements, all existing treaties, conventions, principles, and agreements were considered in effect during the 2020 time frame with one exception. The 1972 antiballistic missile treaty required some changes to permit the missile defense elements played within the force structure to counter the perceived future threat. In addition, SMDC and TRADOC inserted a new international agreement addressing space-based position, navigation, and timing systems.

SPACE FORCE STRUCTURE

AAN activities to date have provided ideas about potential improvements in the space-force structure and space policies used for all AAN activities. In addition, the formulation of those game inputs provided a mechanism for extensive collaboration between a wide array of space-connected institutions across the Army, sister Services, and DOD.

Those efforts led, in turn, to refinement of operational concepts, space policies, and space force structure, that enhance the quality of AAN activity and contribute to the success of Space Game 2 and the Spring Wargame. Although continued development will certainly take place, the foundation established over the past year benefits activities planned during the coming year.

THE ROAD AHEAD

TRADOC-SPONSORED ACTIVITIES

Research and update of the space force structure is a continuous project. The space franchise will conduct research and update and improve the force structure document for use in AAN and other futures activities.

The space franchise will provide players and assessors for all major TRADOC AAN activities,

to include the 1999 Spring Wargame, IIT activities, technology workshops and research activities, and other events as outlined in the AAN FY98 study and research plan.

SPACE FRANCHISE ACTIVITIES

The space franchise will conduct one wargame activity and at least one S/MD IIT. The time frame for Space Game 3 is mid-February 1999. The first IIT was held in August 1998, with a second IIT tentatively planned for December 1998.

Several issues require investigation in Space Game 3. Space Game 2 focused on pre-hostilities and the early stages of war. We now need to investigate the impact of space operations on an extended conflict with emphasis on conflict termination and post-hostilities. Among other things, we expect this shift in focus to generate additional findings for research questions regarding mission assurance. We need to learn more about coordination between space and information operations with other components and functions, such as missile defense, and we need to delve deeper into the impact of commercial-space services on military operations.

OTHER FRANCHISE ACTIVITIES

The space franchise intends to continue its strong support to the IO and SOF franchise efforts and to extend support activities to the CSS franchise. The space franchise will provide players, when requested, to the other Service and OSD wargame activities.

The issues, insights, and impressions emerging from AAN activities to date are numerous and varied. Within the realm of space, the three issue categories cited earlier in this report—space literacy, space integration, and the impact of commercial space on military operations—appear to have continuing relevance. These issue areas will comprise the basis of SMDC inputs to the FY99 AAN study and research plan, as well as to all FY99 space franchise efforts.

Glossary

AAN	Army After Next
ABM	antiballistic missile
ABL	airborne laser
AC	active component
AMC	Army Materiel Command
AO	area of operations
AOE	Army of Excellence
ARL	Army Research Laboratory
ARSOF	Army special operations forces
ASAT	antisatellite
ASPG	Army Strategic Planning Guidance
ATCD	advanced technology concept demonstration
BDA	battle damage assessment
BUSE	battle unit support element
C^2	command and control
C^4I	command, control, communications, computers, and intelligence
C^4ISR	command, control, communications, computers, intelligence, surveillance, and reconnaissance
CASCOM	United States Army Combined Arms Support Command
CD	combat developments
CHS	combat health system
CINC	Commander-in-Chief
CINCSPACE	Commander-in-Chief, United States Space Command
CINCWEST	Commander-in-Chief, Western Command
CONUS	continental United States

CJTF	combined joint task force
CSA	Chief of Staff, Army
CSS	combat service support
DCG	deputy commanding general
DDL	direct downlink
DOD	Department of Defense
DOS	Department of State
DSS	decision support system
DTLOMS	doctrine, training, leader development, organization, materiel, and soldiers
FOC	future operational capability
FORSCOM	United States Army Forces Command
FY	fiscal year
GBL	ground-based laser
GIE	global information environment
GPS	global positioning system
HNS	host nation support
HPM	high-powered microwave
HQ	headquarters
HRO	humanitarian relief organization/operation
IIC	imperatives integration conference
IIT	integrated idea team
IO	information operations
IPB	intelligence preparation of the battlefield
IRBM	intermediate-range ballistic missile
ISR	intelligence, surveillance, and reconnaissance
IW	information warfare
JEF	joint expeditionary force
JIATF	joint interagency task force
JTF	joint task force
JTR	joint transport rotor
KKV	kinetic kill vehicle
LADAR	laser radar

LOS	line-of-sight
MEMS	microelectrical mechanical system
MOUT	military operations in urban terrain
NATO	North Atlantic Treaty Organization
NCA	National Command Authorities
NGO	nongovernmental organization
NLOS	non-line-of-sight
nm	nautical mile
NMD	national missile defense
NMS	national military strategy
NOST	national operations support team
NRO	National Reconnaissance Office
OCONUS	outside the continental United States
OOTW	operations other than war
OSD	Office of the Secretary of Defense
OTM	other than military
PDD	presidential decision directive
PKO	peacekeeping operation
PME	professional military education
PN&T	positioning, navigation, and timing
POW	prisoner of war
PSYOP	psychological operations
PVO	private voluntary organization
RACS	regionally available commercial support
RC	reserve components
RDA	research, development, and acquisition
REF	regional engagement forces
RII	relevant intelligence information
RISTA	reconnaissance, intelligence, surveillance, and target acquisition
RMA	revolution in military affairs
RML	revolution in military logistics
ROE	rules of engagement

RSOI	reception, staging, onward movement, and integration
S&T	science and technology
SARDA	Assistant Secretary of the Army for Research, Development, and Acquisition
SBL	space-based laser
SEAD	suppression of enemy air defense
SECDEF	Secretary of Defense
SFS	space force structure
SMDC	United States Army Space and Missile Defense Command
S/MD IIT	space and missile defense integrated idea team
SOC	Special Operations Command
SOF	special operations forces
SRO	strategic research objective
SRP	study and research plan
SSTOL	super short takeoff and landing
STARTEX	start of exercise
STO	science and technology objective
STOL	short take off and landing
SWG	Spring Wargame
TAV	total asset visibility
TBM	theater ballistic missile
TEC	Topographic Engineering Center
TMD	theater missile defense
TRAC	United States Army Training and Doctrine Command Analysis Center
TRADOC	United States Army Training and Doctrine Command
TWG	tactical wargame
UAV	unmanned aerial vehicle
UGV	unmanned ground vehicle
USAIC	United States Army Infantry Center
USAJFKSWCS	United States Army John F. Kennedy Special Warfare Center and School

USASOC	United States Army Special Operations Command
VTOL	vertical takeoff and landing
WMD	weapons of mass destruction
WWG	Winter Wargame